SUSQUEHANNA RIVER BASIN
BRANCH OF BLACKWATER RUN, SULLIVAN COUNTY

PENNSYLVANIA

MAPLE LAKE DAM

NDI ID NO. PA-01026
DER ID NO. 57-38

RUSSELL E. HOUK

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Prepared by
Geo-Technical Services, Inc.
CONSULTING ENGINEERS & GEOLOGISTS
851 S. 19th Street
Harrisburg, Pennsylvania 17104

For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

AUGUST 1981

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditon of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam:	Maple Lake Dam NDI ID No. PA-01026 DER ID No. 57-38
Size:	Small (14.4 feet high; 126.5 acre-feet)
Hazard Classification:	High
Owner:	Russell E. Houk 605 Country Club Drive Bloomsburg, Pennsylvania 17815
State Located:	Pennsylvania
County Located:	Sullivan
Stream:	Branch of Blackwater Run
Date of Inspection:	July 14, 1981

Based on visual inspection, the Maple Lake Dam is judged to be in good condition. Based on the size and the hazard classification of thd dam, the recommended Spillway Design Flood (SDF) varies from 1/2 PMF (one-half of the Probable Maximum Flood) to the full PMF. Because of the small storage capacity of the reservoir, the 1/2 PMF is selected as the SDF for the Maple Lake Dam. Under the present conditions, the spillway will pass approximately 37 percent of the PMF. Should the top of the dam be restored to its design elevation, the spillway could pass the SDF without overtopping the dam. Overtopping depth of 0.47 foot and overtopping duration of 2.5 hours were calculated for a flood magnitude of 1/2 PMF. It was judged that Maple Lake Dam could withstand the depth and duration of overtopping for the selected SDF without failure. Nevertheless, continuous overtopping of the dam beyond the present spillway capacity and during flood magnitudes that are larger than the 1/2 PMF could cause severe embankment erosion that may affect the integrity of the embankment. Therefore, the spillway is rated as inadequate but not seriously inadequate.

Although the embankment appears to be in good condition, the displaced riprap on the upstream face of the dam and the brush and trees in the spillway outlet channel on the lower downstream slope and at the toe of the dam indicate that these deficiencies should be remedied and included within the maintenance program for the dam.

The following investigations and remedial measures are recommended for immediate implementation by the owner.

(1) Raise the top of the dam to its design elevation, so that the capacity of the spillway can be increased to pass the SDF without overtopping the dam.

(2) Fill in the isolated scarps on the upstream face of the dam with appropriate filter material and replace the dislodged riprap at these locations.

(3) Remove trees and brush from the spillway outlet channel, the lower downstream slope and the toe of the dam.

(4) Monitor the rate and clarity of seepage flow at the toe of the dam, as well as the horizontal and vertical extent of the wet area on each side of the outlet pipe. Take appropirate action as required.

All monitoring programs, design, and supervision of remedial measures should be performed by a Professional Engineer, experienced in the design and construction of dams.

In addition, it is recommended that the owner take the following precautionary operational and maintenance measures:

(1) Develop a detailed emergency operation procedure and warning system to facilitate timely and orderly evacuation of the downstream population if any hazardous conditions at the dam are observed.

(2) When warnings of a storm of major proportions are given by the National Weather Service, activate the emergency operation and warning system procedures.

(3) After satisfactory implementation of the remedial measures resulting from the recommended additional investigations, institute a formal inspection and maintenance program for the dam. As presently required by the Bureau of Dams and Waterway Management of PENNDER,

the program shall include an annual inspection of the dam by a Professional Engineer, experienced in the design and construction of dams. Deficiencies found during annual inspections should be remedied as necessary.

Submitted by:

GEO-TECHNICAL SERVICES, INC.

Gideon Yachin

GIDEON YACHIN, P.E.

Date: August 31, 1981

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 10 Sep 81

MAPLE LAKE DAM (PA-01026)

(SPILLWAY AT ARROW)

OVERVIEW

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MAPLE LAKE DAM
NDI# PA-01026, PENNDER# 57-38

SECTION 1
GENERAL INFORMATION

1.1 Authority.

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

1.2 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.3 Description of Project.

a. Dam and Appurtenances: Maple Lake Dam is an earthfill embankment 14.4 feet high and 283 feet long, excluding spillway. The emergency spillway is located at the left abutment, consisting of an earth channel having a trapezoidal cross section. The bottom width of the spillway at the reservoir outlet is 56 feet. A service spillway, consisting of a 12-inch riser pipe and an 8-inch diameter outlet pipe, is located approximately 100 feet from the right abutment. The outlet works was reported to consist of an 8-inch diameter asbestos cement pipe, extending upstream of the riser pipe to the reservoir and terminating with two sections of an 8-inch diameter vitrified clay pipe, having a concrete plug at the inlet.

b. Location: Maple Lake Dam is located on a branch of Blackwater Run in Elkland Township, Sullivan County, 0.7 mile northeast of State Route 154 at Estella, Pennsylvania. The dam and reservoir are contained within the Overton, Pennsylvania 7.5 Minute Series USGS Quadrangle Map, at Latitude N41°31'07" and Longitude W76°36'55". A Location Map is shown in Exhibit E-1.

c. Size Classification: Small (14.4 feet high, 126.5 acre-feet storage capacity at top of dam).

d. Hazard Classification: High (see paragraph 3.1e).

e. Ownership: Russell E. Houk, 605 Country Club Drive, Bloomsburg, Pennsylvania 17815.

f. Purpose of Dam: Recreation and fire protection.

g. Design and Construction History: Maple Lake Dam was designed by W.R. Stepp, Registered Professional Engineer of Laporte, Pennsylvania. Exhibits E-2, E-3 and E-4 indicate the final revised plans for which a construction permit was issued to Baumunk Lumber Company (the original owner) by the Pennsylvania Water and Power Resources Board on September 9, 1953. Construction started in 1953 under the direction of the design engineer and was completed in August 1954. Although "as-built" drawings are not available, construction specifications, observed deviations from the original design and pertinent correspondence are on file with the Pennsylvania Department of Environmental Resources (PENNDER).

h. Normal Operational Procedure: The pool is maintained at the service spillway crest elevation with excess inflow discharging over the service and emergency spillways into a Branch of Blackwater Run.

1.4 Pertinent Data.

a. Drainage Area: (square miles)	0.62
b. Discharge at Damsite: (cfs)	
Maximum known flood at damsite since construction	Not Known
Outlet works at normal pool elevation, when operable	4
Spillway capacity at maximum pool elevation	
Design Conditions	Not Known
Existing Conditions	624
c. Elevation: (feet above msl) See paragraph 3.1a for Datum	
Top of dam	
Design Conditions	1578.6
Existing Conditions	1578.0
Maximum Pool	
Design Conditions	1578.6
Existing Conditions	1578.0
Normal Pool (at crest of service spillway)	1575.6
Upstream invert outlet works	Not Known
Downstream invert outlet works	1563.6
Streambed at toe of dam	1563.6
d. Reservoir Length: (feet)	
Normal Pool	1460
Maximum Pool (at top of dam)	1560
e. Storage: (acre-feet)	
Normal Pool	76.7
Maximum Pool	
Design Conditions	Not Known
Existing Conditions	126.5

f. Reservoir Surface: (acres)

Normal Pool	16
Maximum Pool	
Design Conditions	Not Known
Existing Conditions	17.2

g. Dam:

Type - Earthfill Embankment

Length - (feet) - excluding spillway	283
Height (feet)	14.4
Top Width (feet)	
Design Conditions	8.0

Existing Conditions - (varies from 7.5' at the right abutment to 15' near the left abutment).

Side Slopes

Design Conditions	
Upstream	1V:2.5H
Downstream	1V:2H

Existing Conditions

Upstream - Vary from 1V:2H near the right abutment to 1V:3H near the left abutment.

Downstream - Vary from 1V:3H at the right abutment to 1V:4.5H at the left abutment.

Zoning - Homogeneous earthfill embankment.

Cutoff - 6' wide trench, having 1V:1H side slopes and excavated to impervious foundations under the entire length of the embankment.

Impervious Core

Foundations - Compacted backfill within cut-off trench.

Embankment - See Zoning

Grout Curtain	None

h. Diversion and Regulating Tunnel: None

i. Spillway:

Type

Service Spillway - 12" diameter riser pipe and 8" diameter outlet pipe.

Emergency Spillway - An earth channel, having a trapezoidal cross sectional area.

Crest Elevation	
Service Spillway - Top of riser pipe	1575.6
Emergency Spillway - At outlet from reservoir	1575.8
At spillway bridge section	1574.7
Length of Crest (feet)	
Service Spillway - circumference of riser pipe	3.1
Emergency Spillway	56

i. (spillway - continued)

Upstream Channel - Bottom slope 3% (upstream of bridge).

Downstream Channel - 3% along the first 18 feet (downstream of bridge), steepening to 8% downstream of the embankment.

j. Outlet Works:

Type - 8-inch diameter transite pipe, extending into the reservoir from the bottom of the riser pipe and terminating with two sections of vitrified clay pipe.

Length (feet) 80

Closure and Regulating Facilities - a concrete plug at the pipe inlet. Release of water by breaking the clay pipe.

Access - From boat (by probing), or by diving.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available: Design data available for review consist of the 1953 drawings, specifications, inspection reports, correspondence and photographs obtained from PENNDER files. Design drawings and photographs depicting conditions during and after construction of the facility are presented in Appendix E.

b. Design Features:

(1) Embankment: The dam was designed as a homogeneous earthfill embankment with 1V:2.5H (1 Vertical on 2.5 Horizontal) upstream slope and 1V:2H downstream slope. A cut-off trench with a 6-foot bottom width and 1V:1H side slopes was to be excavated to impervious foundations under the entire length of the embankment and backfilled with compacted earthfill from unspecified borrow sources. Earthfill was to be placed on the cleared, grubbed and stripped embankment foundations in 6-inch lifts and compacted with at least 10 passes of a sheeps foot roller, having a tooth pressure of not less than 500 pounds per square inch, to the required density. Three-inch lifts were to be placed in areas inaccessible by a roller and to be compacted with pneumatic tampers. The upstream slope was to be protected by a minimum of 12-inch riprap, from the top of the embankment crest to a 6-foot vertical distance below the crest, or to a 3-foot vertical distance below the normal pool. The downstream slope was to be seeded. The width of the embankment crest was to be 8 feet.

(2) Appurtenant Structures:

(a) Service Spillway: The spillway was to consist of a 12-inch diameter transite pipe riser with crest elevation 3 feet below the top of the dam. An 8-inch diameter transite pipe was to convey spillway discharges into the streambed.

(b) Emergency Spillway: The spillway was to be excavated into hard shale on the left abutment and to consist of a trapezoidal cross sectional area, having a 60-foot wide bottom with a crest elevation at the reservoir outlet being 2.5 feet below the crest of the embankment. The spillway outlet channel was to have a curved alignment with a 60-foot bottom width and a 2% slope, terminating approximately 80 feet from the left bank of the stream and 9 feet above the streambed.

(c) Outlet Works: The outlet works was to consist of an 8-inch diameter transite pipe, extending from the bottom of the service spillway riser pipe into the reservoir for an approximate distance of 27 feet. The entire length of the 8-inch diameter outlet pipe, both upstream and downstream of the riser pipe, was to be encased in 6-inches of concrete. Two anti-seep collars, 8 inches thick and extending 2 feet from the concrete

encasement, were to be located downstream of the cut-off trench. The outlet works inlet was to consist of two sections of VCP (Vitrified Clay Pipe), protruding upstream of the concrete encasement and having a concrete plug.

c. Specific Design Criteria: The emergency spillway design criteria was based on peak discharge of 950 cubic feet per second (cfs) per square-mile drainage area. For the 0.6 square-mile drainage area upstream of the dam, the minimum required spillway discharge capacity was 570 cfs.

2.2 Construction Records.

Review of the inspection reports and correspondence indicates that the bottom of the emergency spillway did not terminate in hard shale. The concrete encasement for the 8-inch diameter outlet pipe was limited to that portion of the pipe between the riser and the downstream anti-seep collar. The balance of the pipe was reported to be placed on top of bedrock. The earth embankment was reported to consist largely of red and yellow clay, intermixed with some sand and gravel. *By carefully controlling the travel of the construction equipment over the embankment and the manner of placing the material, an embankment was produced varying between 91 and 97 percent of the maximum density as determined by the Modified Proctor Density Test.* Due to heavy rains during construction, the reservoir was impounded to approximately 85 percent of its storage capacity on two occasions. Careful examination of downstream conditions by the design engineer failed to disclose any seepage along the outlet pipe or through the embankment.

2.3 Operational Records.

There are no formal operational records for the dam.

2.4 Other Investigations.

Inspection of the dam on July 6, 1965 indicated a growth of trees and brush on the downstream slope and the toe of the embankment. The trees were removed by the present owner prior to September 1965, as indicated in Exhibit E-6, Appendix E. Assignment of the permit for the dam to the present owners was approved by the Pennsylvania Water and Power Resources Board on October 29, 1965.

2.5 Evaluation.

a. Availability of Data: Although "as-built" plans for the dam and appurtenant structures are not available, data obtained from PENNDER files provide information relative to the chronology of construction and deviations of construction features from the original design.

b. Adequacy: In the absence of "as-built" plans and formal construction records, assessment of the structural integrity of the dam and its

safety must be based on the combination of available cited data, visual inspection, performance history, as well as hydrologic and hydraulic analysis (see Section 5).

c. Validity: There is no reason to question the validity of the available data.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General: The overall appearance of the dam is good. Deficiencies observed during the field inspection are noted on the General Plan, Exhibit A-1, and are described in the subsequent paragraphs. The profile and typical sections of the dam are presented in Exhibits A-2, A-3 and A-4 and are based on field survey made on the day of the inspection. The survey datum for this inspection is based on interpolation of the USGS contour map, presented in Exhibit E-1, Appendix E. The elevations shown on the design drawings (Exhibits E-2, E-3 and E-4) are based on a different datum than that of the USGS map. Therefore, to convert the elevations shown on the appended design drawings to the elevations used in this report, it is necessary to add 20 feet to the elevations shown on the appended drawings. On the inspection date (7/14/1981), the lake level was at normal pool which is the crest of the service spillway (elevation 1575.6 above mean sea level). Visible features of the dam and appurtenant structures are depicted in photographs, presented in Appendix C.

b. Embankment: Observations made during the field inspection indicate that the embankment is in good condition. The upstream slope above the normal pool varies from 1V:2H (1 Vertical on 2 Horizontal) near the right abutment to 1V:3H near the left abutment (see Photographs 3, 4, 5, 6, and 8, Appendix C). The downstream slope varies from 1V:3H at the right abutment to 1V:4.5H at the left abutment (see Photographs 5 and 9, Appendix C). To top width of the dam varies from 7.5 feet at the right abutment to 15 feet near the left abutment (see Typical Dam Sections, Exhibit E-3, and Photographs 4, 5, and 9, Appendix C). The top of dam elevation is 1578, which is 2.4 feet higher than the normal pool. Hand placed riprap on the upstream face was reported to extend three feet below the normal pool elevation (see paragraph 2.1b (1)). The riprap is generally in good condition except for 5 limited erosion scarps (12" to 18" high and 24" to 36" wide) where large riprap boulders were displaced. The upper limit of the riprap terminates below the crest of the dam, as shown in Exhibit A-2 and Photograph 8, Appendix C. The visible portion of the upstream slope, the crest of the embankment and most of its downstream slope are grassed and well maintained. Trees and brush are located on the lower slope of the dam and at the toe between the left bank of the stream and the left abutment (see Exhibit A-1 and Photographs 7 and 9, Appendix C). A wet area is located on the lower downstream slope of the dam, extending approximately 10 feet to the left and to the right of the outlet pipe. The upper limit of this wet area forms a near horizontal line on the downstream slope, approximately 1.5 feet above the outlet works invert (see Photograph 7, Appendix C). The total estimated seepage flow from the wet area was 1 GPM (Gallons per Minute). Rock outcrops are visible in the streambed and along the right abutment (see Appendix F).

c. Appurtenant Structures:

(1) Emergency Spillway: The overall appearance of the spillway is good, except for the growth of brush and small trees (up to 8" diameter) downstream of the spillway bridge (see Photograph 5, Appendix C). Spillway design features are described in paragraph 2.1b(2)b and shown in Exhibit E-3, Appendix E. The observed features vary from the design features. The bottom width of the trapezoidal channel at the lake's outlet is 56 feet, rather than the 60-foot width shown in the design drawings. The bottom slope of the channel is 3% along the first 60 feet of its length, steepening to 8% slope, downstream of the embankment (see Exhibit A-4, Appendix A). The appended design drawings indicate a 2% bottom slope along the entire alignment of the spillway. The bottom width of the spillway narrows to a 7-foot wide outlet channel, approximately 70 feet downstream of the aforementioned break in the channel bottom slope. An arch shaped bridge, having a wooden deck over steel beams and supported by 8-inch diameter wooden piles, is located along the dam axis and across the spillway channel (see Exhibit A-2, Appendix A and Appendix D). The bottom of the spillway channel is lined with riprap for a distance of 35 feet upstream of the break in the spillway channel slope (see Exhibit A-4). The crest elevation of the spillway channel at the lake's outlet is 0.2-foot above the normal pool level, which is 2.2 feet below the lowest crest elevation of the dam.

(2) Service Spillway: The design features of this facility are described in paragraph 2.1b(2)(a), and are shown in Exhibit E-4, Appendix E. The existing conditions are presented in Exhibit A-4, Appendix A. There was virtually no flow through the service spillway on the day of the inspection. A trash rack, consisting of steel rods, is located on the top of the riser pipe (see Photograph 6, Appendix C). The outlet pipe and the tailwater at the toe of the dam are shown in Photograph 7, Appendix C. A large number of small (2-inch long) dead fish was found within the first 50-foot stretch downstream of the outlet pipe. It was reported that the lake was stocked with fish just prior to the inspection date. Rainfall on July 13, 1981 raised the lake level above the normal pool, resulting in the transport of the fish through the service spillway into the stream.

(3) Outlet Works: The outlet works design features are described in paragraph 2.1b(2)(c) and are shown in Exhibit E-4, Appendix E. The inlet is reported plugged with concrete. Release of water through the outlet works is by breaking the 8-inch diameter vitrified clay pipe that protrudes from the concrete encasement at the bottom of the reservoir.

d. Reservoir Area: Approximately 50 percent of the 0.6 square mile watershed is wooded. The right abutment is moderately steep, rising from the normal pool level (elevation 1575.6) to elevation 1600 along a distance of 200 feet. The left abutment across the emergency spillway channel does not exceed elevation 1580 for a distance of approximately 200 feet and has a slight depression whose low point is at elevation 1578.2 (see Exhibits A-1 and A-2, Appendix A and Photograph 4, Appendix C). Approximately one acre of ground to the left of the spillway bridge appears to be graded and presumed to result from borrow excavation during the construction of the embankment.

Upstream of Maple Lake Dam an impoundment owned by Keith McCarty is located at the northern part of the watershed (see Exhibit E-1, Appendix E and Photograph 10, Appendix C). McCarty Lake has a surface area of 6.5 acres at normal pool, which is 2 feet below the crest of the dam. The dam is 18 feet high and 600 feet long, excluding spillway. The spillway channel has been filled in and the present spillway capacity is limited to a flow through a 24-inch diameter CMP culvert under the spillway fill. The invert of this culvert is but 0.5-foot above the normal pool. A slotted 6-inch diameter PVC Riser Pipe maintains the normal pool level in the lake. The earthfill dam has steep upstream and downstream slopes (1V:1.5H). The upstream slope has riprap protection and the downstream slope is seeded. The crest of the dam is located immediately upstream of a road, shown in Exhibit E-1 and Photograph 10. Discharges from the dam cross beneath the road through a 24-inch diameter CMP culvert. The low point on the top of the road is approximately 11 feet below the top of the dam. It has been reported (Mrs. Leljedal of the Village of Estella, Telephone (717) 924-3938) that the dam overtopped during the 1972 flood, causing great concern in the Village of Estella.

e. Downstream Channel: The average slope of the stream along the first 1000 feet downstream of Maple Lake Dam is 5.7%. A service road owned by the Maple Lake Camp crosses the stream. The stream crossing consists of a loose rockfill, instead of an open culvert to pass stream flows. From the service road to the confluence with Blackwater Run, the average slope of the stream channel is 5%. The average slope of Blackwater Run below the confluence is 2.5%. At least 10 residences and business establishments are located between the dam and the confluence of Blackwater Run with Kings Creek (see Exhibit E-1 and Photographs 11, 12 and 13, Appendix C).

Survey of the downstream conditions indicates that more than a few lives can be lost and a significant property damage incurred should the dam fail. Consequently, the Maple Lake Dam is classified as a high hazard structure.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operating Procedure.

The reservoir is maintained at normal pool level with the excess inflow discharging over the service spillway into the downstream channel. The upstream control for the outlet pipe is operable by breaking a section of vitrified clay pipe, located at the bottom of the Lake (see also paragraph 2.1b(2)(c)).

4.2 Maintenance of Dam.

The earth embankment is well maintained (see Photographs 5, 6, 8 and 9, Appendix C), except for displaced riprap in five locations on the upstream slope (see paragraph 3.1b) and the trees and brush on the bottom of the downstream slope and at the toe of the embankment. Trees and brush in the spillway outlet channel indicate that the spillway is not properly maintained.

4.3 Maintenance of Operating Facilities.

There are no mechanically operating facilities for the dam. The method of operating the outlet works is described in paragraph 4.1.

4.4 Warning System in Effect.

There is no emergency operation and warning system in effect at the present time.

4.5 Evaluation.

The overall appearance of the dam is good. The maintenance of the spillway outlet channel is inadequate. The owner should institute regularly scheduled maintenance inspections. Findings and subsequent maintenance and repair work should be documented. An emergency operation and warning system and a plan to evacuate downstream population should be instituted by the owner to prevent loss of life resulting from a dam failure. The warning system should account for the off-season periods when the facility is unattended.

SECTION 5
HYDROLOGY AND HYDRAULICS

5.1 Design Data.

The permit given by the Pennsylvania Water and Power Resources Board stipulates that the spillway design meets the criteria to pass 950 cfs (cubic feet per second) per square mile of the drainage area above the dam. Consequently, the spillway design capacity for the 0.6-square mile drainage area above the dam was 570 cfs. The drainage area above the dam was verified to be 0.6 square mile.

5.2 Experience Data.

The probable flood of record in Blackwater Run is the June 1972 flood. Flood stages or flow records at the damsite are not available. No records are available on the maximum stage of the reservoir nor to indicate past overtopping of the Maple Lake Dam. Mrs. Russell E. Houk, the owner's wife, stated that during the June 1972 flood, the depth of water in the emergency spillway was approximately 6 inches. Flood marks from the 1972 flood have been reported for the Village of Estella, 1.2 miles downstream of the dam (see paragraph 3.1e).

5.3 Visual Observations.

Based on the visual inspection and field survey, described in Section 3 of this report, the observations relevant to hydrology and hydraulics are evaluated below.

a. Embankment: The present low point on top of the dam is at elevation 1578.0, or 0.6-foot below the design elevation for the top of the dam.

b. Service Spillway: The crest of the 12-inch diameter riser pipe service spillway is at elevation 1575.6. Flow over the riser pipe discharges through an 8-inch diameter outflow pipe into the streambed at the toe of the dam.

c. Emergency Spillway: The crest of the emergency spillway at the reservoir outlet is at elevation 1575.8, or 0.2-foot higher than the normal pool elevation. The emergency spillway crest length is 56 feet, which is the bottom width of the trapezoidal shaped earth channel spillway, having a curved alignment. The bottom slope of the channel is 3% along the first 60 feet of its length, steepening to 8% and terminating 9 feet above the streambed on the left bank of the stream. A bridge spans the spillway along the axis of the dam. The cross section of the spillway channel upstream of the bridge is irregular and the bottom width of the channel is narrower than the length of the spillway crest.

d. Reservoir Area: An upstream impoundment (McCarty Lake) is located at the upper reach of the Maple Lake watershed. McCarty Lake has a surface area of 6.5 acres at normal pool that is maintained by a 6-inch diameter riser pipe. The present spillway consists of a 24-inch diameter corrugated metal pipe whose invert elevation is 0.5-foot above the normal pool. The 650-foot long earthfill dam (including a filled-in spillway channel) is 18 feet high. McCarty Dam was reported to overtop during the 1972 flood. Should this dam fail by overtopping during floods, the outflow resulting from the breached dam would add to the peak inflow into Maple Lake. There are no visible indications to suggest drastic change in the prevailing watershed land use to significantly alter the rate of inflow into Maple Lake during extreme floods.

e. Downstream Conditions: The spillway capacity is not affected by tailwater conditions. Flood stages in the Village of Estella may be affected by the confluence of Blackwater Run with Kings Creek (see paragraph 3.1e). Based on guidelines established for these studies, no consideration was given to the effect of the confluence on the flood stages within the hazard area.

5.4 Method of Analysis.

Hydrologic and hydraulic evaluation was made in accordance with the procedures and guidelines established by the U.S. Army, Corps of Engineers, Baltimore District, Phase I Safety Inspection of Dams. The analysis has been performed utilizing the HEC-1DB program developed by the U.S. Army Corps of Engineers, Hydrologic Engineering Center, Davis, California. A brief description of program capabilities, as well as the input and output data used specifically for this analysis, is presented in Appendix D.

5.5 Summary of Analysis.

a. Spillway Design Flood (SDF): According to criteria established by the Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) for the size (small) and hazard potential (high) of the Maple Lake Dam is between the one-half Probable Maximum Flood (1/2 PMF) and the full PMF. Because of the small storage capacity of the reservoir, the 1/2 PMF is selected as the SDF for the Maple Lake Dam.

b. Results of Analysis: Pertinent results are tabulated in Appendix D. The analysis reveals that under the prevailing top of dam elevations, the spillway discharge is 624 cfs when the water surface in the reservoir reaches the low point on the dam crest. This condition is equivalent to a flood magnitude of approximately 37 percent of the PMF. Should the top of the dam be restored to its design elevation, the spillway could pass the SDF without overtopping the dam. The maximum rates of inflow and outflow from the reservoir, corresponding to a flood magnitude of PMF, are 1893 and 1884 cfs, respectively. For a flood magnitude of 1/2 PMF, the derived inflow and outflow peak rates are 946 cfs and 878 cfs, respectively. The dam is overtopped by 0.12-foot and 0.47-foot during peak outflow resulting from flood magnitudes of 40% and 50% of the PMF. The duration of overtopping that corresponds to the aforementioned floods is 1 and 2.5 hours, respectively.

5.6 Spillway Adequacy.

It was judged that Maple Lake Dam could withstand the overtopping depth and duration, resulting from the selected SDF, without failure. Therefore, the present spillway capacity is rated as inadequate, but not seriously inadequate.

SECTION 6
EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations.

The visual inspection of Maple Lake Dam is described in Section 3. Observations that are relevant to the structural stability of the dam and appurtenant structures are evaluated below.

a. Embankment: The downstream slope and the visible part of the upstream slope are stable. The displaced riprap, resulting in five erosion scarps on the upstream slope of the dam, should be repaired to prevent progressive erosion of the slope. The 1 GPM clear seepage, emanating from the wet area at the toe of the dam, does not appear to be detrimental to the stability of the embankment. Should the extent of the wet area and the rate of seepage be increased in the future, additional investigation will have to be made and corrective measures taken, if required.

b. Emergency Spillway: Despite the steep slope of the spillway outlet channel, there is no evidence of erosion on the bottom of the channel, that in time, can undermine the toe of the dam.

c. Service Spillway and Outlet Works: Although computed outlet pipe velocities exceed 10 feet per second, there is no erosion in the streambed that can, in time, undermine the toe of the dam.

6.2 Design and Construction Data.

Available design and construction data are inadequate to assess the present stability of the dam; thus, the evaluation is based on visual inspection.

6.3 Past Performance.

The available data do not indicate any previous occurrences of structural problems in the dam and appurtenances.

6.4 Seismic Stability.

The dam is located in Seismic Zone 1 and may be subject to minor dynamic forces induced by earthquakes. Normally, it can be considered that if a dam is stable under static loading conditions, it can be assumed safe to withstand minor earthquake loading. Although Maple Lake Dam is judged to be structurally stable under the prevailing conditions, no computations were made to evaluate this condition.

SECTION 7

ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety:

(1) Based on visual inspection, the Maple Lake Dam is judged to be in good condition. Based on the size and the hazard classification of the dam, the recommended Spillway Design Flood (SDF) varies from 1/2 PMF (one-half of the Probable Maximum Flood) to the full PMF. Because of the small storage capacity of the reservoir, the 1/2 PMF is selected as the SDF for the Maple Lake Dam. Under the present conditions, the spillway will pass approximately 37 percent of the PMF. If the top of the dam is restored to its design elevation, the spillway could pass the SDF without overtopping the dam. Overtopping depth of 0.47-foot and overtopping duration of 2.5 hours were calculated for a flood magnitude of 1/2 PMF. It was judged that Maple Lake Dam could withstand the depth and duration of overtopping for the selected SDF without failure. Nevertheless, continuous overtopping of the dam beyond the present spillway capacity and during flood magnitudes that are larger than the 1/2 PMF could cause severe embankment erosion that may affect the integrity of the embankment. Therefore, the spillway is rated as inadequate, but not seriously inadequate.

(2) Although the embankment appears to be in good condition, the displaced riprap on the upstream face of the dam and the brush and trees in the spillway outlet channel on the lower downstream slope and at the toe of the dam indicate that these deficiencies should be remedied and included within the maintenance program for the dam.

(3) There is no warning system and evacuation plan in effect at the present time.

b. Adequacy of Information. The data collected from previously cited dam inspection reports, past performance, visual inspection and computations performed as part of this study are sufficient for the Phase I safety assessment, delineated in sub-paragraph a., above.

c. Urgency: The recommendations in Paragraph 7.2 should be implemented as soon as practical or as dictated by the recommended additional investigations that follow.

d. Necessity for Further Investigations: In order to accomplish some of the remedial measures outlined in paragraph 7.2, further investigations will be necessary.

7.2 Recommendations and Remedial Measures.

a. The following investigations and remedial measures are recommended

for immediate implementation by the owner.

(1) Raise the top of the dam to its design elevation so that the capacity of the spillway can be increased to pass the SDF without overtopping the dam.

(2) Fill in the isolated scarps on the upstream face of the dam with appropriate filter material and replace the dislodged riprap at these locations.

(3) Remove trees and brush from the spillway outlet channel, the lower downstream slope and the toe of the dam.

(4) Monitor the rate and clarity of seepage flow at the toe of the dam, as well as the horizontal and vertical extent of the wet area on each side of the outlet pipe. Take appropriate action as required.

All monitoring programs, design, and supervision of remedial measures should be performed by a Professional Engineer, experienced in the design and construction of dams.

b. In addition, it is recommended that the owner take the following precautionary operational and maintenance measures:

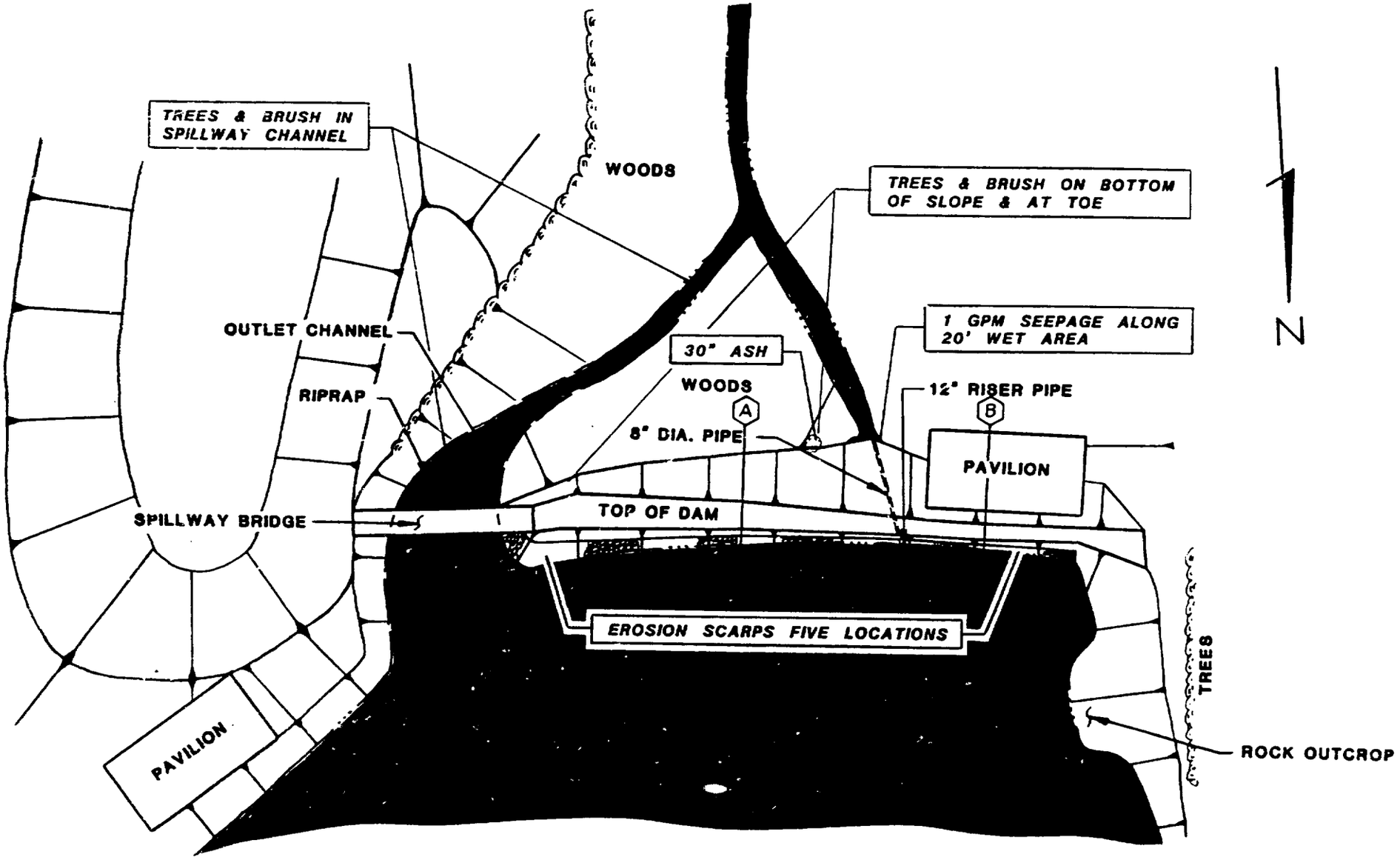
(1) Develop a detailed emergency operation procedure and warning system to facilitate timely and orderly evacuation of the downstream population if any hazardous conditions at the dam are observed.

(2) When warnings of a storm of major proportions are given by the National Weather Service, activate the emergency operation and warning system procedures.

(3) After satisfactory implementation of the remedial measures resulting from the recommended additional investigations, institute a formal inspection and maintenance program for the dam. As presently required by the Bureau of Dams and Waterway Management of PENNDER, the program shall include an annual inspection of the dam by a Professional Engineer, experienced in the design and construction of dams. Deficiencies found during annual inspections should be remedied as necessary.

APPENDIX A

VISUAL INSPECTION - CHECKLIST AND FIELD SKETCHES



MAPLE LAKE DAM
GENERAL PLAN - FIELD INSPECTION NOTES

EXHIBIT A-1

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

JOB MAPLE LANE
SHEET NO 1 OF 1
CALCULATED BY RJM DATE 7-20-81
CHECKED BY _____ DATE _____
SCALE HORZ. 1"=100' VERT. 1"=4'

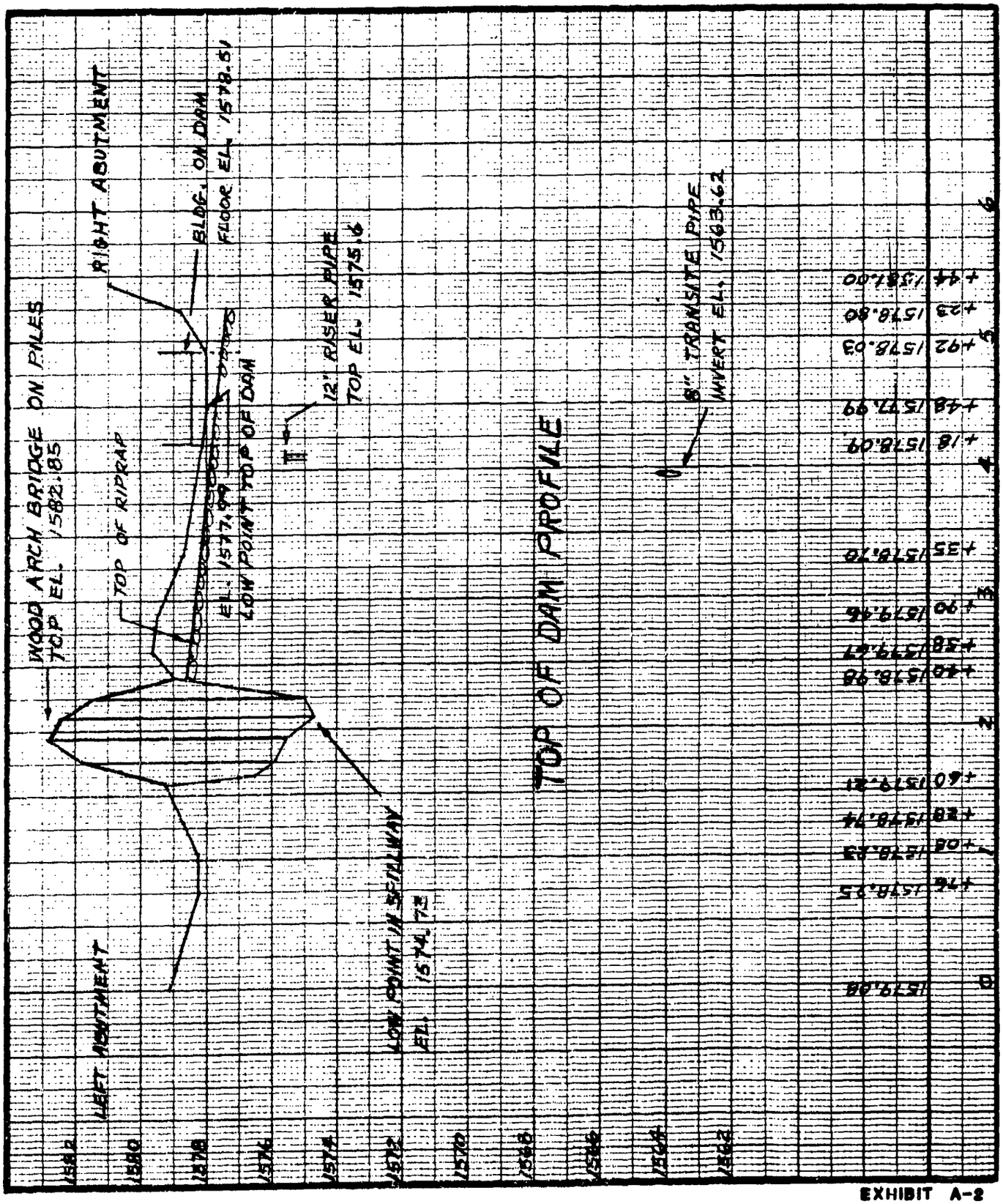
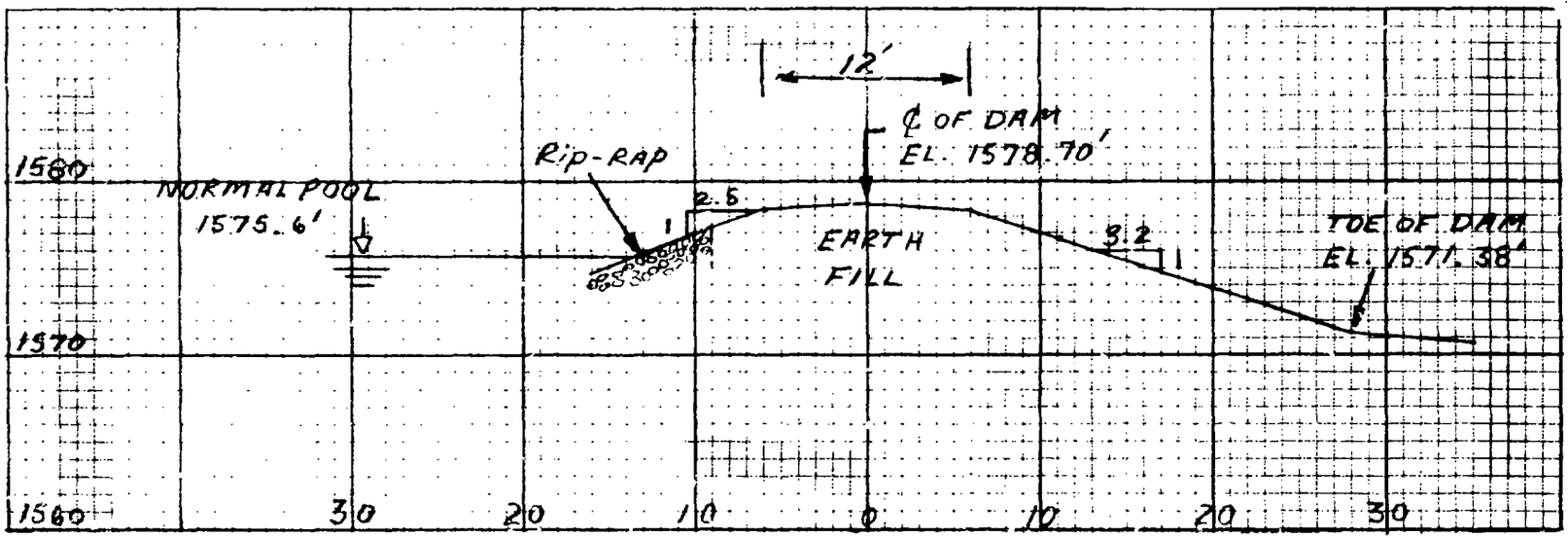
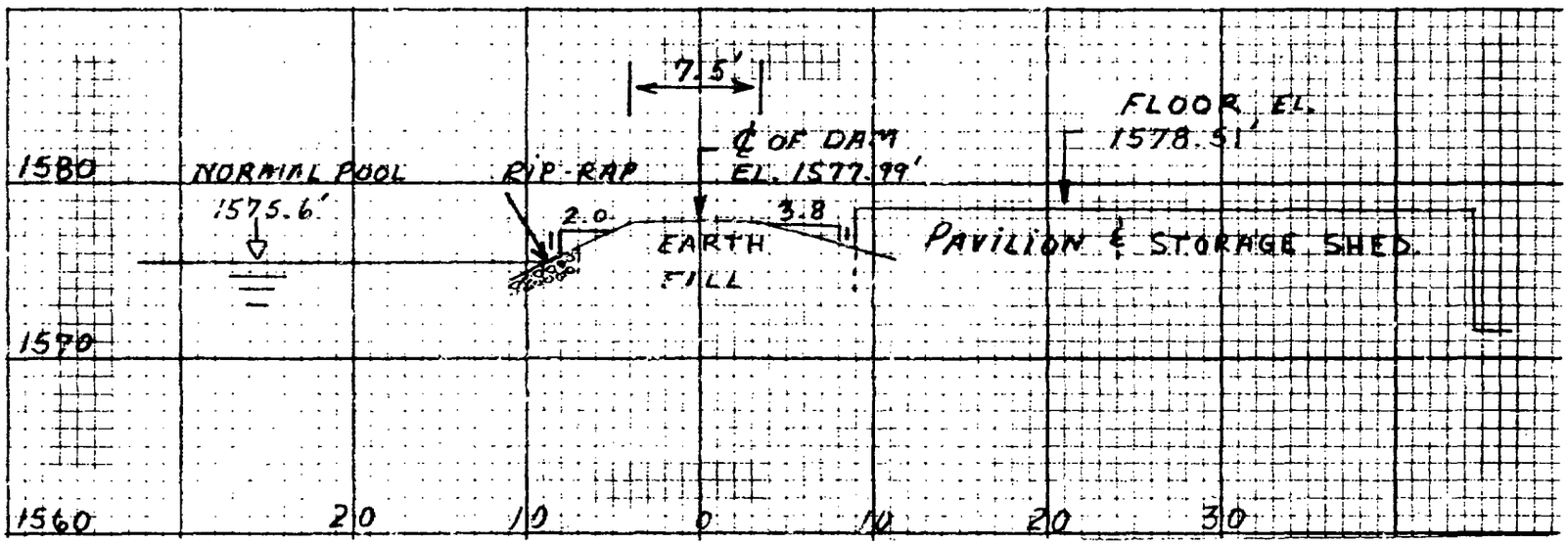


EXHIBIT A-2

TYPICAL DAM SECTIONS



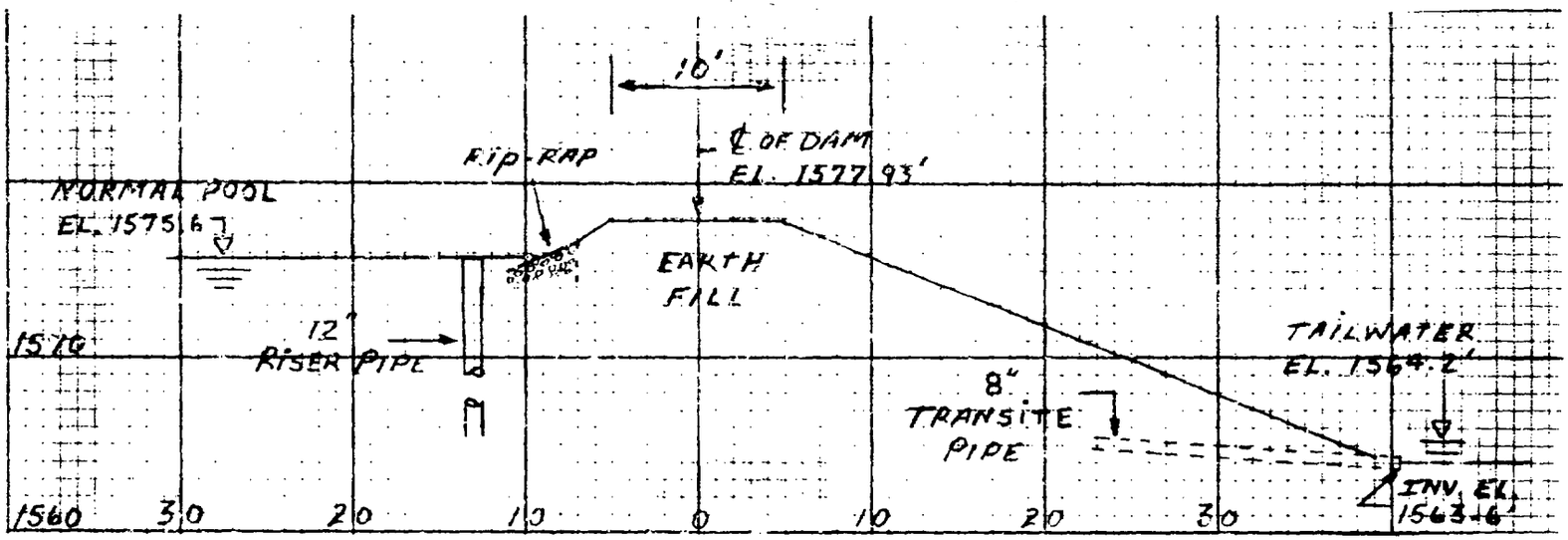
SECTION A



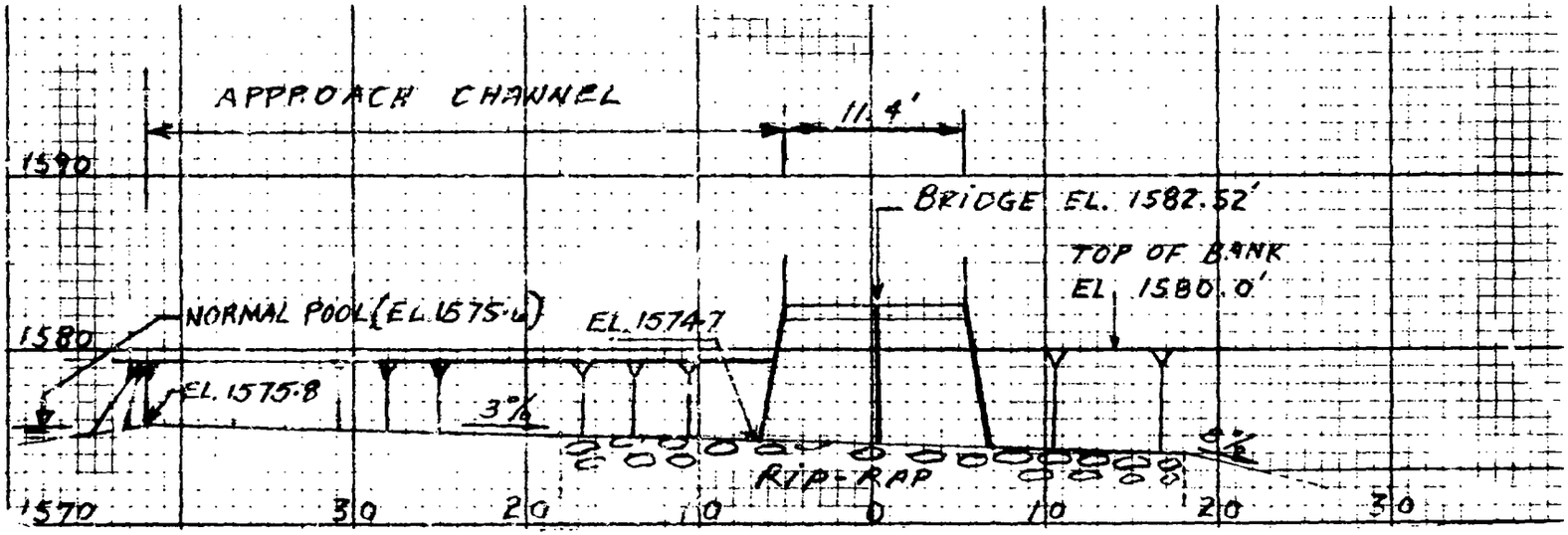
SECTION B

EXHIBIT A-8

TYPICAL DAM SECTIONS



OUTLET WORKS



SPILLWAY SECTION

EXHIBIT A-4

CHECK LIST
VISUAL INSPECTION
PHASE 1

NAME OF DAM Maple Lake Dam STATE Pennsylvania COUNTY Sullivan

NDI # PA — 01026 PENNDER # 57-38

TYPE OF DAM Earth Fill SIZE Small HAZARD CATEGORY High

DATE(S) INSPECTION July 14,1981 WEATHER Partly cloudy TEMPERATURE 26°C @ 11 AM

POOL ELEVATION AT TIME OF INSPECTION 1575.6 M.S.L.

TAILWATER AT TIME OF INSPECTION 1564.2 M.S.L.

INSPECTION PERSONNEL	OWNER REPRESENTATIVES	*OTHERS*
J. Diaz, Geologist	Mrs. Russel E. Houk	
G. Yachin, Engineer		
R. Mather, Surveyor		

RECORDED BY J. Diaz

EMBANKMENT

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 01026
SURFACE CRACKS	None.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Good horizontal alignment. For vertical alignment, see Exhibit A-2.
RIPRAP FAILURES	Riprap in good condition except for five limited erosion scarps (12"-18" H x 24"-36" W) where large riprap boulders were displaced.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good. No erosion or leakage.

EMBANKMENT

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA-01026
DAMP AREAS IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	None.
ANY NOTICEABLE SEEPAGE	About 10' Right and 10' Left of 8" outlet pipe and 12 to 18" above invert is a horizontal seepage zone (total flow about 1 GPM).
STAFF GAGE AND RECORDER	None.
DRAINS	None.
ROCK OUTCROPS	Right Abutment 50-75' Dwnstrm.- at Ground surf. Red shale strike N30-40°W 5-10°SW. " " 50-75' Upstrm.- at Ground surf. Red shale strike NS Dip 10°W. " "50-75' & 150-200' Upstrm. 6-10'Cliffs of Red shale and fine sandstone strike N 30-40°W Dip 10-15°SW. About 10' left of outlet pipe, horizontal red shale exposed in creek bed.
VEGETATION	Brush and small trees along Lower downstream slope & toe. One 30" Ash Tree at toe 15' Left of outlet pipe.

OUTLET WORKS

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 01026
INTAKE STRUCTURE	Not visible. Reported to be 8" TC pipe plugged with concrete.
OUTLET CONDUIT (CRACKING AND SPALLING OF CONCRETE SURFACES)	8" Dia. Transite pipe. Outlet end is 3/4 submerged (no end wall or concrete encasement). Total discharge including seeps is about 2 GPM.
OUTLET STRUCTURE	None.
OUTLET CHANNEL	Natural wooded stream channel.
GATE(S) AND OPERATIONAL EQUIPMENT	None.

EMERGENCY SPILLWAY

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 01026
TYPE AND CONDITION	Excavated earth channel with dumped stone bottom (50'± W x 35' L) and earth slopes. Good condition except for growth of brush and small trees to 8" Dia. downstream of spillway bridge.
APPROACH CHANNEL	Grass and weed filled channel widens from about 50' at dam centerline to about 60' wide 20' upstream.
SPILLWAY CHANNEL AND SIDEWALLS	Earth slopes (1 V qn 3 H) covered with brush, weeds and small trees to 8" Dia.
STILLING BASIN PLUNGE POOL	None.
DISCHARGE CHANNEL	Excavated earth channel with dumped stone bottom narrowing from 50' to about 10' wide in a distance 70' downstream of dam centerline. Dense brush and trees to 8" dia. in channel & slopes.
BRIDGE AND PIERS EMERGENCY GATES	An arched wooden bridge (Four 8" Dia. wood piers upstream and downstream,12" wide plank deck, 8" H steel I beams) Clearance 5.5-6.0'. Top of deck is about 4'above top of dam.

SERVICE SPILLWAY

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 01026
TYPE AND CONDITION	A 12" Dia. Transite riser pipe near center of dam (see Exhibit A-1) with 3/4"steel rod grating connected to 8" Dia. Transite outlet pipe. Both in good condition.
APPROACH CHANNEL	None.
OUTLET STRUCTURE	None.
DISCHARGE CHANNEL	Natural wooded stream channel.

INSTRUMENTATION

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 01026
MONUMENTATION SURVEYS	None.
OBSERVATION WELLS	None.
WEIRS	None.
PIEZOMETERS	None.
OTHERS	

RESERVOIR AREA AND DOWNSTREAM CHANNEL

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 01026
SLOPES: RESERVOIR	Right side: steep wooded slopes with near horizontal bedrock outcrops. Left side & Upstream: wooded gentle slopes. There are no slope conditions that could affect the safety of the dam.
SEDIMENTATION	None.
DOWNSTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	Natural wooded channel.
SLOPES: CHANNEL VALLEY	Moderate slopes (1V on 3H) in natural wooded channel.
APPROXIMATE NUMBER OF HOMES AND POPULATION	About 10 residences, a sawmill, a repair shop and a nursing home. *(see table on the following sheet).*

DESCRIPTION OF DOWNSTREAM HAZARD

DISTANCE DOWNSTREAM OF DAM (FT)	DESCRIPTION OF BUILDINGS	PROXIMITY TO STREAM	
		DISTANCE FEET	HEIGHT ABOVE STREAMBED
5000	Mobile Home	200 Left	4'
6100	2-Story Green Residence	20 Right	9.8'
6200	* L & H Lumber Co. - Main Bldg.	50 Left	7.0'
6200	2-Story White Dwelling	50 Right	7.0'
6500	* 1½ Story Green Dwelling	30 Right	9.5'
6650	1½ Story Repair Shop	30 Right	8.0'
6700	Mobile Home	30 Right	6.5'
6700 - 6900	3 Homes	50 to 150 Right	10.0'±
7000	Darway Nursing Home below confluence with Kings Creek	160 Right	15.0'±

* *Reported to be flooded in the 1972 flood.*

APPENDIX B

ENGINEERING DATA - CHECKLIST

CHECK LIST
ENGINEERING DATA
PHASE I

NAME OF DAM Maple Lake Dam

ITEM	REMARKS	NDI# PA - 01026
PERSONS INTERVIEWED AND TITLE	Mrs. Russel E. Houk, Owner's wife	
REGIONAL VICINITY MAP	See Exhibit E-1, Appendix E	
CONSTRUCTION HISTORY	Designed by W.R. Stepp, Registered Professional Engineer, in 1952. Construction started in 1953 under the direction of the design engineer and was completed in 1954.	
AVAILABLE DRAWINGS	See Exhibits E-2, E-3 and E-4, Appendix E	
TYPICAL DAM SECTIONS	For typical sections obtained by survey (7/14/1981), see Appendix A	
OUTLETS PLAN DETAILS DISCHARGE RATINGS	For design drawings, see Appendix E. For existing conditions, see Appendix A	

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS NDI# PA 01026
SPILLWAY PLAN SECTION DETAILS	For design drawings see Appendix E. For existing conditions, see Appendix A.
OPERATING EQUIP MENT PLANS AND DETAILS	Not applicable (no operating equipment)
DESIGN REPORTS	None available
GEOLOGY REPORTS	None available. For general geologic description of the dam site, see Appendix F.
DESIGN COMPUTATIONS: HYDROLOGY AND HYDRAULICS STABILITY ANALYSES SEEPAGE ANALYSES	None available other than noted. 1952 design criteria reported as 950 cfs per square mile of drainage area above dam.
MATERIAL INVESTIGATIONS: BORING RECORDS LABORATORY TESTING FIELD TESTING	None available

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS	NDI# PA - 01026
BORROW SOURCES	Not known. Approximately one acre on the left abutment appears to be graded, indicating possible borrow source.	
POST CONSTRUCTION DAM SURVEYS	None available prior to 1981. For conditions on 7/14/81, see top of dam profile and typical sections, Appendix A.	
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	1965 dam inspection report	
HIGH POOL RECORDS	No formal records are available	
MONITORING SYSTEMS	None	
MODIFICATIONS	None since construction. For reported design deviations, see paragraph 2.2, Section 2.	

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS	NDI# PA-01026
PRIOR ACCIDENTS OR FAILURES	Not reported	
MAINTENANCE RECORDS MANUAL	None available	
OPERATION RECORDS MANUAL	None available	
OPERATIONAL PROCEDURES	Self-regulating.	
WARNING SYSTEM AND/OR COMMUNICATION FACILITIES	Not provided	
MISCELLANEOUS	Overtopping of an upstream dam (McCarty Dam) was reported during the June 1972 flood.	

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

NDI ID # PA-01026
PENNDER ID # 57-38

SIZE OF DRAINAGE AREA: 0.62 square mile

ELEVATION TOP NORMAL POOL: 1575.6 STORAGE CAPACITY: 76.7 acre-feet

ELEVATION TOP FLOOD CONTROL POOL: NA STORAGE CAPACITY: NA

ELEVATION MAXIMUM DESIGN POOL: 1578.6 STORAGE CAPACITY: Unknown

ELEVATION TOP DAM: 1578.0 STORAGE CAPACITY: 126.5 acre-feet

SPILLWAY DATA	SERVICE SPILLWAY	EMERGENCY SPILLWAY
CREST ELEVATION:	1575.6	1575.8
TYPE:	12" Dia. Riser Pipe	Trapezoidal Earth Channel
CREST LENGTH:	3.14' (circumference)	56 feet
CHANNEL LENGTH:	45' of 8" Dia. Pipe	140' approx. (Total Length)
SPILLOVER LOCATION:	Near right abutment	Left abutment
NUMBER AND TYPE OF GATES:	None	

OUTLET WORKS

TYPE: 8" diameter transite pipe

LOCATION: Extending upstream of riser pipe

ENTRANCE INVERTS: Not known

EXIT INVERTS: Elevation 1563.6

EMERGENCY DRAWDOWN FACILITIES: Two sections of 8" dia. VCP, plugged at inlet. Operable by breaking.

HYDROMETEOROLOGICAL GAGES

TYPE: None

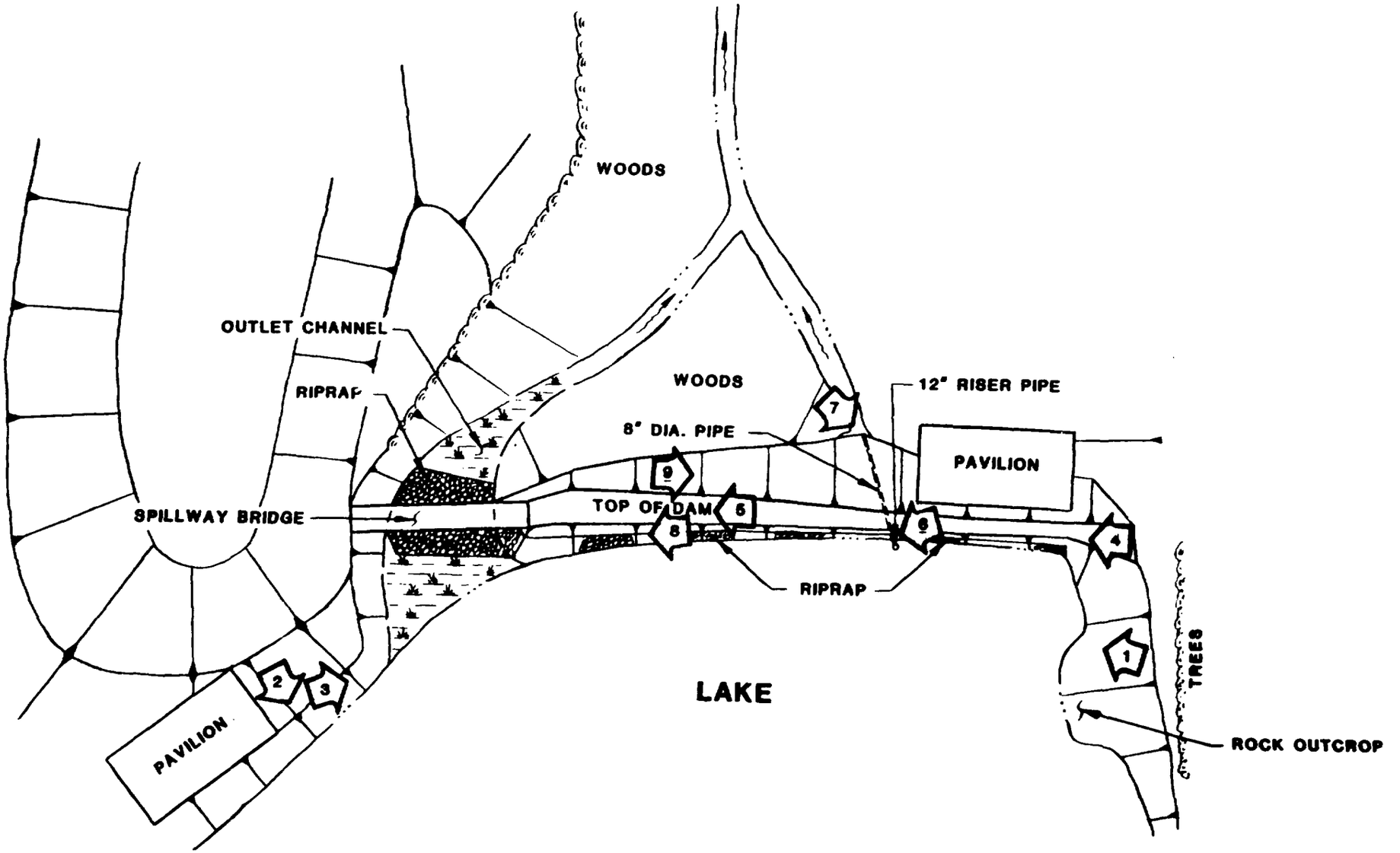
LOCATION: NA

RECORDS: NA

MAXIMUM NON-DAMAGING DISCHARGE: 624 cfs

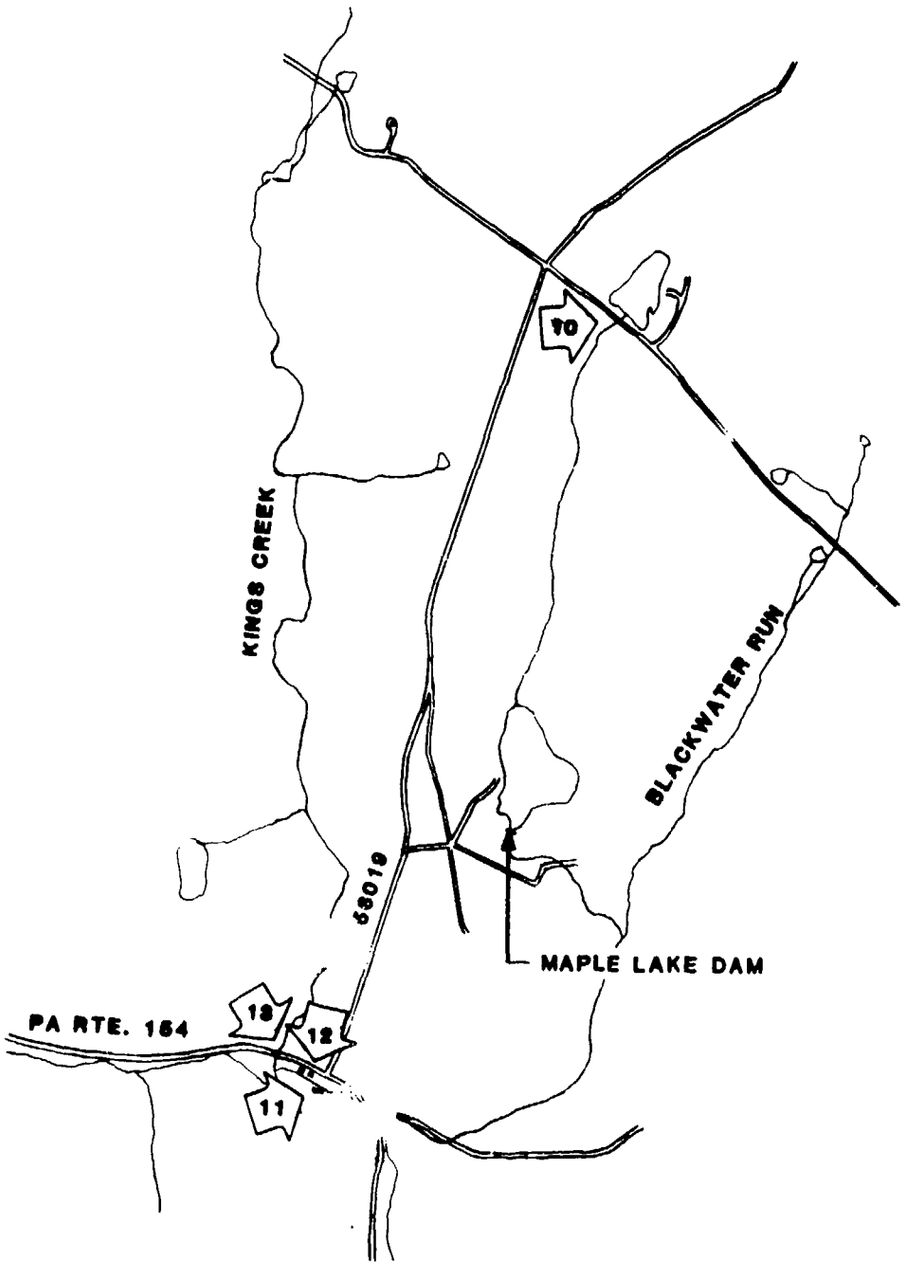
APPENDIX C

PHOTOGRAPHS



MAPLE LAKE DAM
PHOTOGRAPHS LOCATION MAP

EXHIBIT C-1



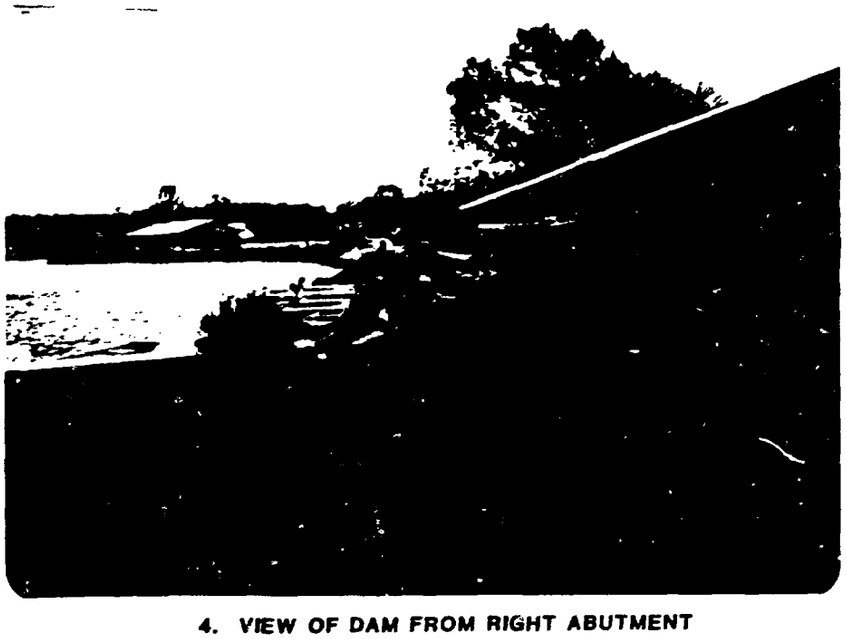
MAPLE LAKE DAM
UPSTREAM & DOWNSTREAM PHOTOGRAPHS LOCATION MAP

EXHIBIT C-2

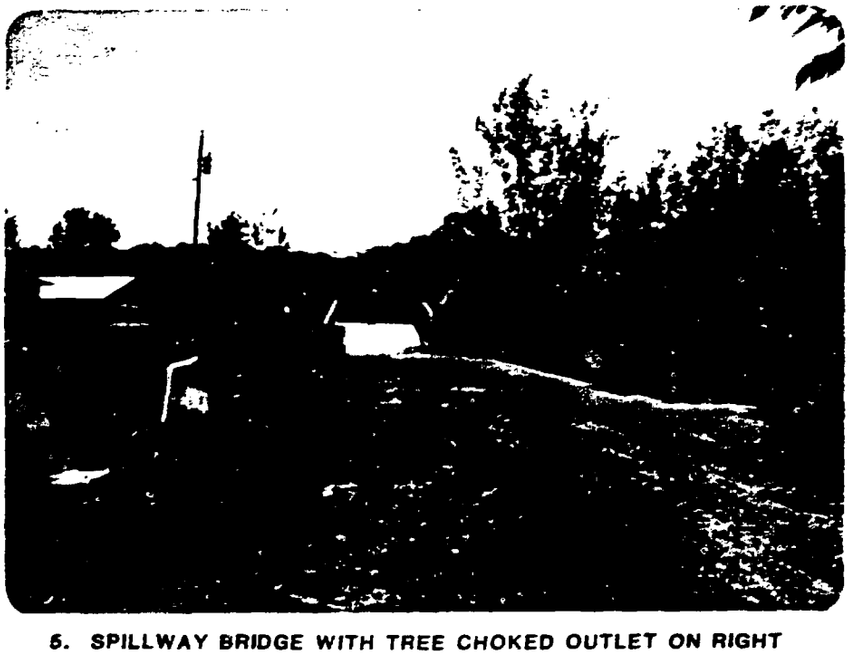
1. AERIAL VIEW OF DAM (12/01/1980)

2. UPSTREAM VIEW OF MAPLE LAKE (7/14/1981)

3. UPSTREAM FACE OF DAM (SHOWING SEASONAL USE OF LAKE)

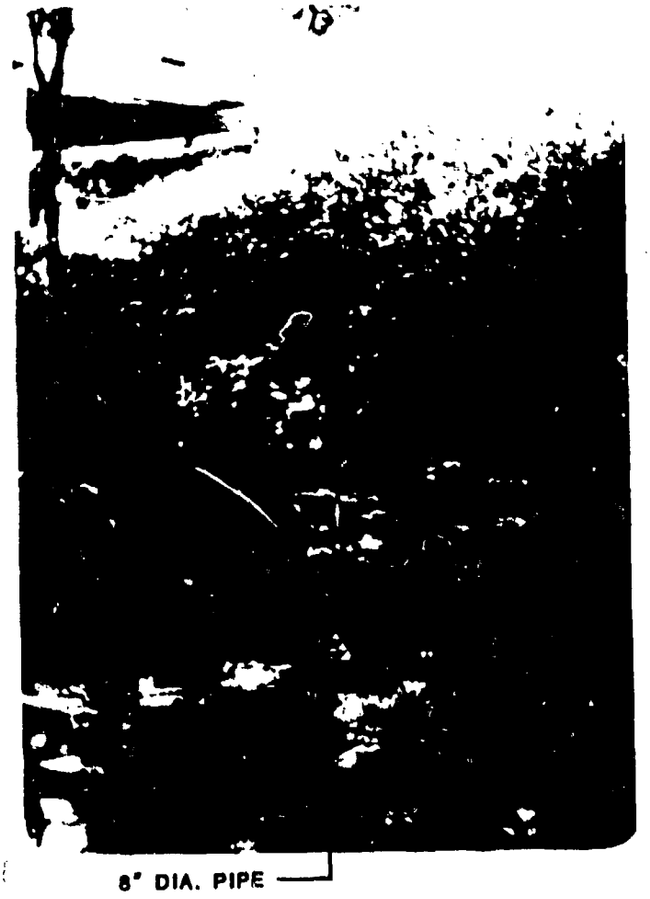


4. VIEW OF DAM FROM RIGHT ABUTMENT



5. SPILLWAY BRIDGE WITH TREE CHOKED OUTLET ON RIGHT

6. UPSTREAM SLOPE OF DAM (FACING LEFT ABUTMENT)



7. DOWNSTREAM EMBANKMENT SLOPE
OUTLET WORKS IN FOREGROUND

(WET AREA 20' LONG & 1.5' ABOVE INVERT)

8. UPSTREAM SLOPE OF DAM
(SHOWING UPPER LIMIT OF RIPRAP)

9. DOWNSTREAM SLOPE OF MAPLE LAKE DAM
(FACING RIGHT ABUTMENT)

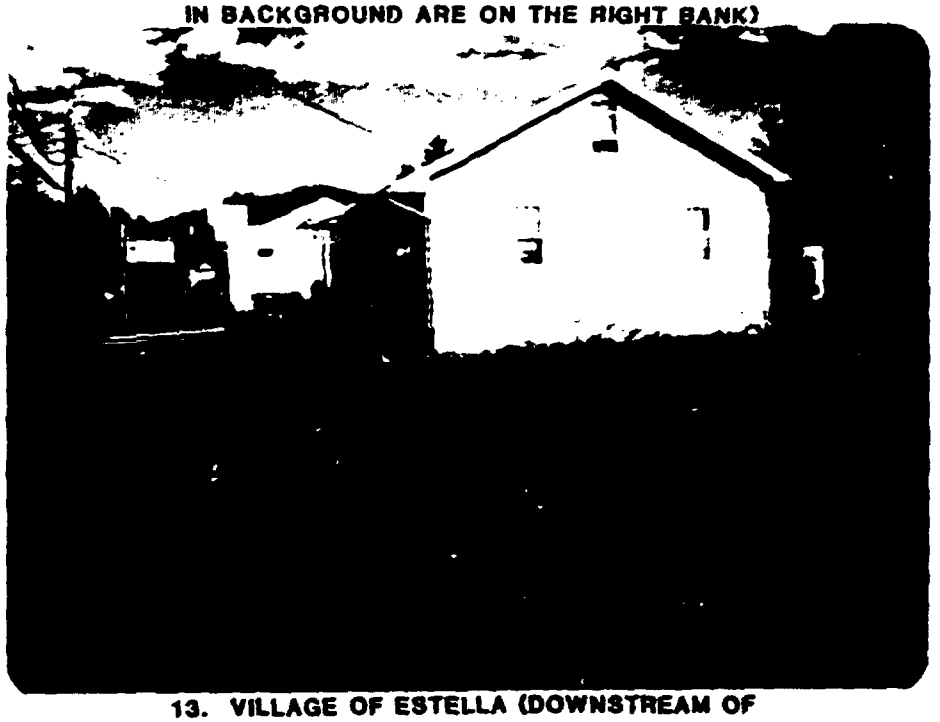
10. McCARTY LAKE AND DAM
UPSTREAM VIEW FROM LEFT ABUTMENT
(THIS DAM IS LOCATED UPSTREAM OF MAPLE LAKE)

DOWNSTREAM HAZARD

PHOTO NO.	DISTANCE FROM DAM	HEIGHT ABOVE STREAMBED
11.	6,200'	7'
12.	6,700'	6.5' - 9.5'
13.	6,900'	10' - 11'

11. L & H LUMBER CO., FACING UPSTREAM (LUMBER STACKS ON LEFT STREAM, HOMES IN BACKGROUND ARE ON THE RIGHT BANK)

12. VILLAGE OF ESTELLA (STREAM IS BEHIND TRAILER, RIGHT OF PHOTO)



13. VILLAGE OF ESTELLA (DOWNSTREAM OF PHOTO 12; STREAM IS 150' RIGHT OF HOME)

APPENDIX D

HYDROLOGY AND HYDRAULICS

SUMMARY DESCRIPTION
OF
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY INVESTIGATIONS

The hydrologic and hydraulic evaluation for this inspection report has employed computer techniques using the Corps of Engineers computer program identified as the Flood Hydrograph Package (HEC-1) Dam Safety Version.

The program has been designed to enable the user to perform two basic types of hydrologic analyses: (1) the evaluation of the over-topping potential of the dam, and (2) estimate the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. A brief summary of the computation procedures typically used in the dam overtopping analysis is shown below.

- Development of an inflow hydrograph to the reservoir.
- Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.
- Routing of the outflow hydrograph(s) of the reservoir to desired downstream locations. The results provide the peak discharge, time of the peak discharge and maximum stage of each routed hydrograph at the outlet of the reach.

The output data provided by this program permits the comparison of downstream conditions just prior to a breach failure with that after a breach failure and the determination as to whether or not there is a significant increase in the hazard to loss of life as a result of such a failure.

The results of the studies conducted for this report are presented in Section 5.

For detailed information regarding this program, refer to the Users Manual for the Flood Hydrograph Package (HEC-1), Dam Safety Investigations prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California.

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

JOB MAPLE LAKE TA-1066
SHEET NO. _____ OF _____
CALCULATED BY WEH DATE 7/29/81
CHECKED BY _____ DATE _____
SCALE _____

1.) GENERATE HYDROGRAPH FOR McCARTY LAKE (SUB-AREA 1).

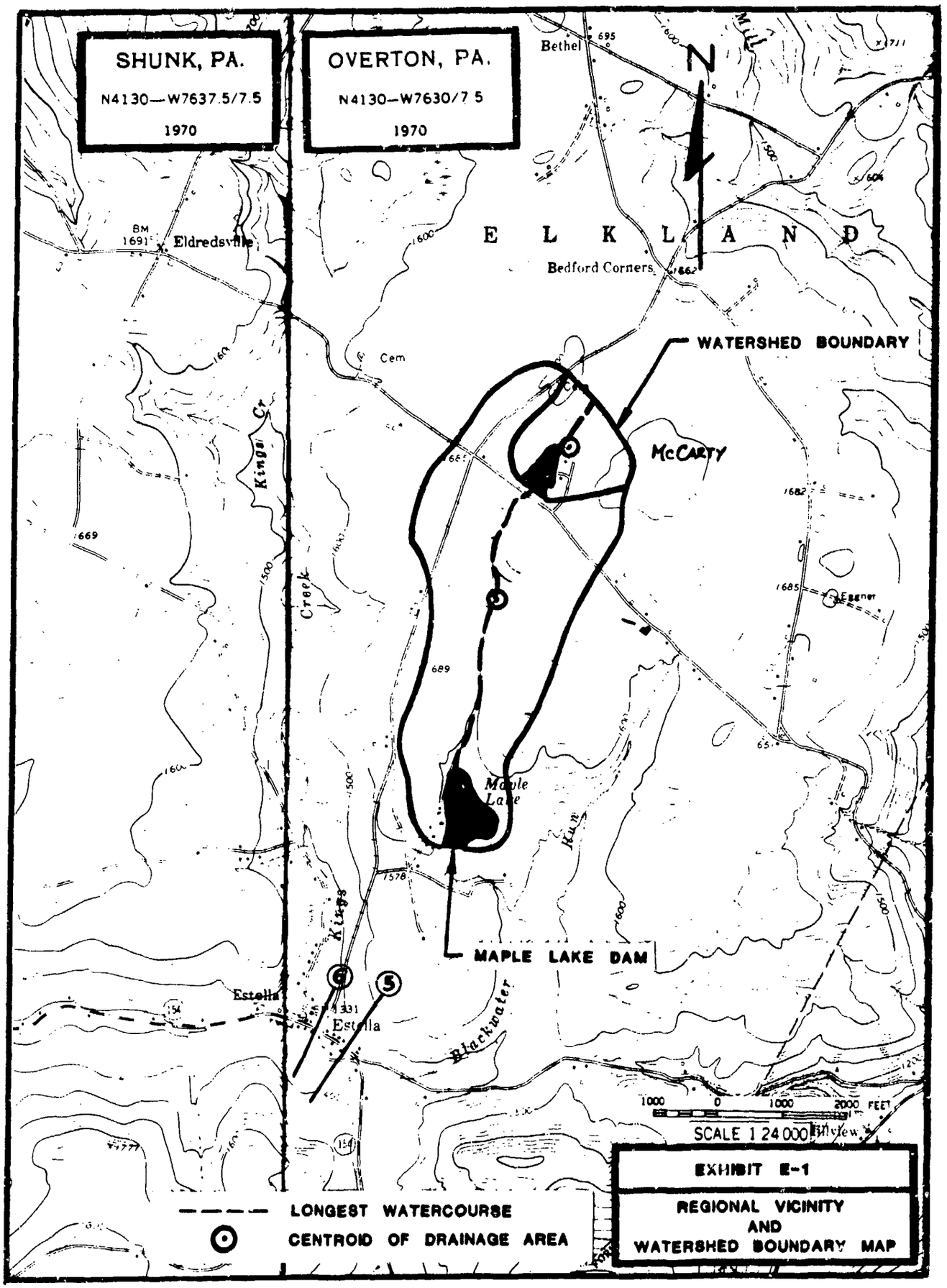
2.) ROUTE THRU McCARTY LAKE

3.) ROUTE TO MAPLE LAKE

4.) GENERATE HYDROGRAPH FOR SUB-AREA 2

5.) COMBINE HYDROGRAPHS

6.) ROUTE THRU MAPLE LAKE


SHUNK, PA.
N4130—W7637.5/7.5
1970
OVERTON, PA.
N4130—W7630/7.5
1970
N
E L K L A N D
Bethel
Eldredsville
Bedford Corners
Cem
WATERSHED BOUNDARY
McCARTY
Maple Lake
MAPLE LAKE DAM
Estella
Kings Creek
Blackwater Run
1000 0 1000 2000 FEET
SCALE 1 24 000
LONGEST WATERCOURSE
CENTROID OF DRAINAGE AREA
EXHIBIT E-1
REGIONAL VICINITY AND WATERSHED BOUNDARY MAP

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

SHEET NO 1 OF
CALCULATED BY [signature] DATE 5/81
CHECKED BY DATE
SCALE

GENERAL DATA - MAPLE LAKE DAM

RIVER BASIN	SUSQUEHANNA
STREAM NAME	BLACKWATER RUN
NDI I.D. NO	PA - 1026
DER I.D. NO	57 - 038
OWNER	R. E. HOUK
LOCATION	ELKLAND TWP.
CO.	SULLIVAN
QUAD.	OVERTON
LAT.	41° - 31' - 07"
LONG.	76° - 36' - 55"
SIZE	SMALL
HAZARD	HIGH
DRAINAGE AREA	0.62 Sq. Mi.

Watershed Features

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

JOB MAPLE LAKE MA.-1026
SHEET NO _____ OF _____
CALCULATED BY WEH DATE 7/28/81
CHECKED BY _____ DATE _____
SCALE _____

MAPLE LAKE DAM

DRAINAGE BASIN & UNIT HYDROGRAPH DATA

DRAINAGE AREA 0.53 Sq. Mi.

SNYDER UNIT HYDROGRAPH COEFFICIENTS
AS SUPPLIED BY BALT. DIST. COE (SUSQUEHANNA BASIN ZONE 17)

Cp = 0.05
Ct = 1.13

LAG TIME = $Tp = Ct(L \times Lca)^{0.3}$
L = 1.13 mi. RESERVOIR OUTLET TO DRAINAGE DIVIDE
Lca = 0.76 mi RESERVOIR OUTLET TO CENTROID

$\therefore Tp = 1.13(1.13 \times 0.76)^{0.3} = 1.08$ HRS

RAINFALL DATA

PER HYDROMETEOROLOGICAL REPORT No. 40

PMF RAINFALL = 22.2" (24 HR @ 200 Sq. Mi.)
GEOGRAPHIC ADJUSTMENT FACTOR = 0.99
$\therefore$ PMP = 22.2 × 0.99 = 22.0"

RAINFALL DISTRIBUTION

6 HR	118%
12 HR	127%
24 HR	136%
48 HR	142%

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

JOB MAPLE LAKE MA-1026
SHEET NO _____ OF _____
CALCULATED BY WEH DATE 7/28/81
CHECKED BY _____ DATE _____
SCALE _____

MAPLE LAKE (CONT.)

DAM DATA

TOP OF DAM ELEV. (LOW POINT)	1578.0
DAM LENGTH (INC. SPILLWAY)	370'
DAM HEIGHT	14.4'
DAM WIDTH	VARIES

NON-LEVEL DAM

LENGTH OF DAM	BELOW ELEV.
0'	1578.0
42'	1578.1
185'	1578.7
205'	1579.0
253'	1579.4
292'	1579.6
295'	1580
303'	1581

SPILLWAY DATA

COMPUTE RATING CURVE # INPUT DIRECTLY

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

JOB

SHEET NO. OF

CALCULATED BY G.Y. DATE 7/23/1981

CHECKED BY DATE

MAPLE LAKE DAM

SPILLWAY RATING TABLE

RESERVOIR W.S. ELEV. (FEET)	DISCHARGE (CFS)			
	SERVICE SPILLWAY	EMERGENCY SPILLWAY	BANK OVERFLOW	TOTAL
1575.60	0	0	0	0
1575.80	0.9	0	0	0.9
1576.10	3.5	28.5	0	32
1576.40	4.2	81.4	0	85
1577.00	4.3	259.8	0	264
* 1578.00	4.4	619.6	0	624
1578.20	4.5	699.6	0	704
1578.80	4.6	899.5	53	957
1579.00	4.6	1130.5	120	1255
1580.00	4.7	1320.5	820	2145
1581.00	4.8	1505.5	2300	3810
1582.00	4.9	2251.4	4700	6956

* Begin overtopping of dam crest

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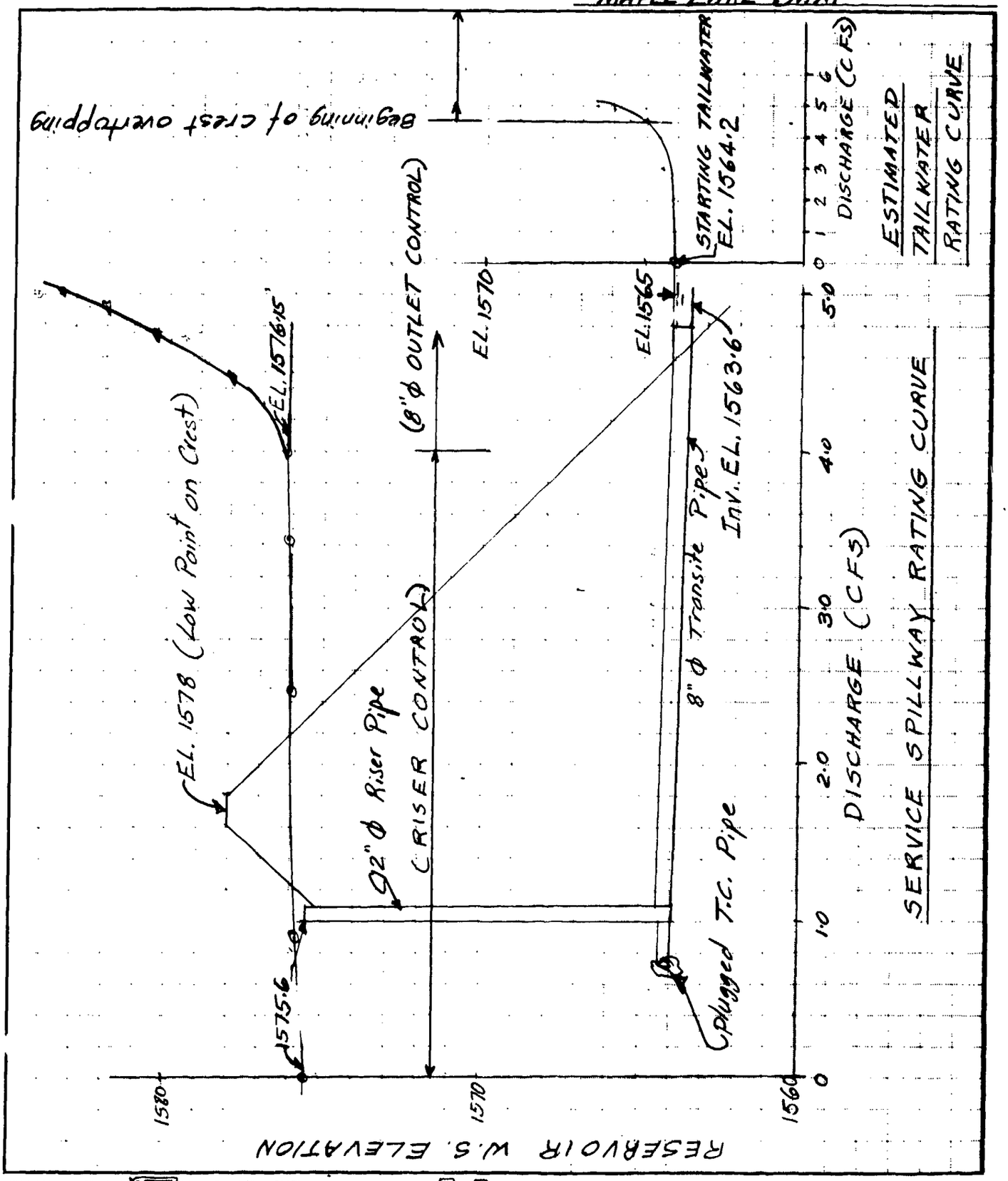
SHEET NO. OF

CALCULATED BY G.Y. DATE 7/24/1981

CHECKED BY DATE

MAPLE LAKE DAM



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JOB
SHEET NO. OF
CALCULATED BY G.Y. DATE 7/24/1981
CHECKED BY DATE

MAPLE LAKE DAM

SERVICE SPILLWAY RATING CURVE

Pertinent Data:
Top of 12" ϕ Riser Pipe, EL. 1575.6
Invert EL. of 8" ϕ outlet Pipe 1563.6
Starting Tailwater Elev. (by Survey) 1564.2

a. Flow Controlled by 8" ϕ Asbestos Cement outlet pipe
Ref. Handbook of Concrete Culvert Pipe Hydraulics, Portland Cement Assoc. 1964

Head Loss in pipe $H = \left[\frac{2.5204(1+k_e)}{D^4} + \frac{466.18 n^2 L}{D^{16/3}}\right] \times \left(\frac{Q}{10}\right)^2$

Where k_e is the Entrance loss coefficient
n is the pipe roughness coefficient
D is the pipe diameter, in feet
L is Length of pipe, in feet
Q is the discharge, in cfs

For $D = 0.667'$; $k_e = 0.5$; $n = 0.015$ and $L = 53'$

$H = 67.4\left(\frac{Q}{10}\right)^2$; $Q = \sqrt{\frac{100H}{67.4}} = 1.22\sqrt{H}$

H feet	Q cfs	TAILWATER ELEVATION	W.S. ELEVATION IN RISER	W.S. ELEVATION IN RESERVOIR*	
1.5	1.49	1564.2	1565.7	1575.88	
2.0	1.73	1564.3	1566.3	1575.92	
2.5	1.93	1564.3	1566.8	1575.94	
3.0	2.11	1564.3	1567.3	1575.96	
3.5	2.28	1564.4	1567.9	1575.98	
4.0	2.44	1564.4	1568.4	1576.00	
6.0	2.99	1564.5	1570.5	1576.05	
8.0	3.45	1564.6	1572.6	1576.10	
11.0	4.05	1564.6	1575.6**	1576.15	PIPE CONTROL → RISER CONTROL →
13.4	4.47	1564.6	1578.0	1578.0	
15.0	4.73	1565.5	1580.5	1580.5	
16.0	4.88	1566.0	1582.0	1582.0	
17.0	5.03	1566.5	1583.5	1583.5	

* See b. - Riser control ** Top of Riser

SERVICE SPILLWAY RATING CURVE (CONT.)

b. FLOW OVER CREST OF RISER PIPE

$$Q = 3.1 \pi D H^{3/2}$$

Where πD is the Length of spillway crest
H is the head over the spillway crest

W.S. ELEV IN RESERV.	HEAD H(ft)	Q cfs	CORRECTED W.S. ELEV	REMARKS
1575.6	0	0	1575.6	
1575.8	0.2	0.87	1575.8	Flow controlled
1576.0	0.4	2.47	1576.0	by riser pipe
1576.1	0.5	3.45	1576.1	
1576.15	0.55	4.00	1576.15	
1576.2	0.60	4.47	1578.0	
1576.22	0.62	4.73	1580.5	Flow controlled
1576.23	0.63	4.88	1582.0	by 8"ϕ outlet pipe
1576.24	0.64	5.03	1583.5	(See Sheet D-9)

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

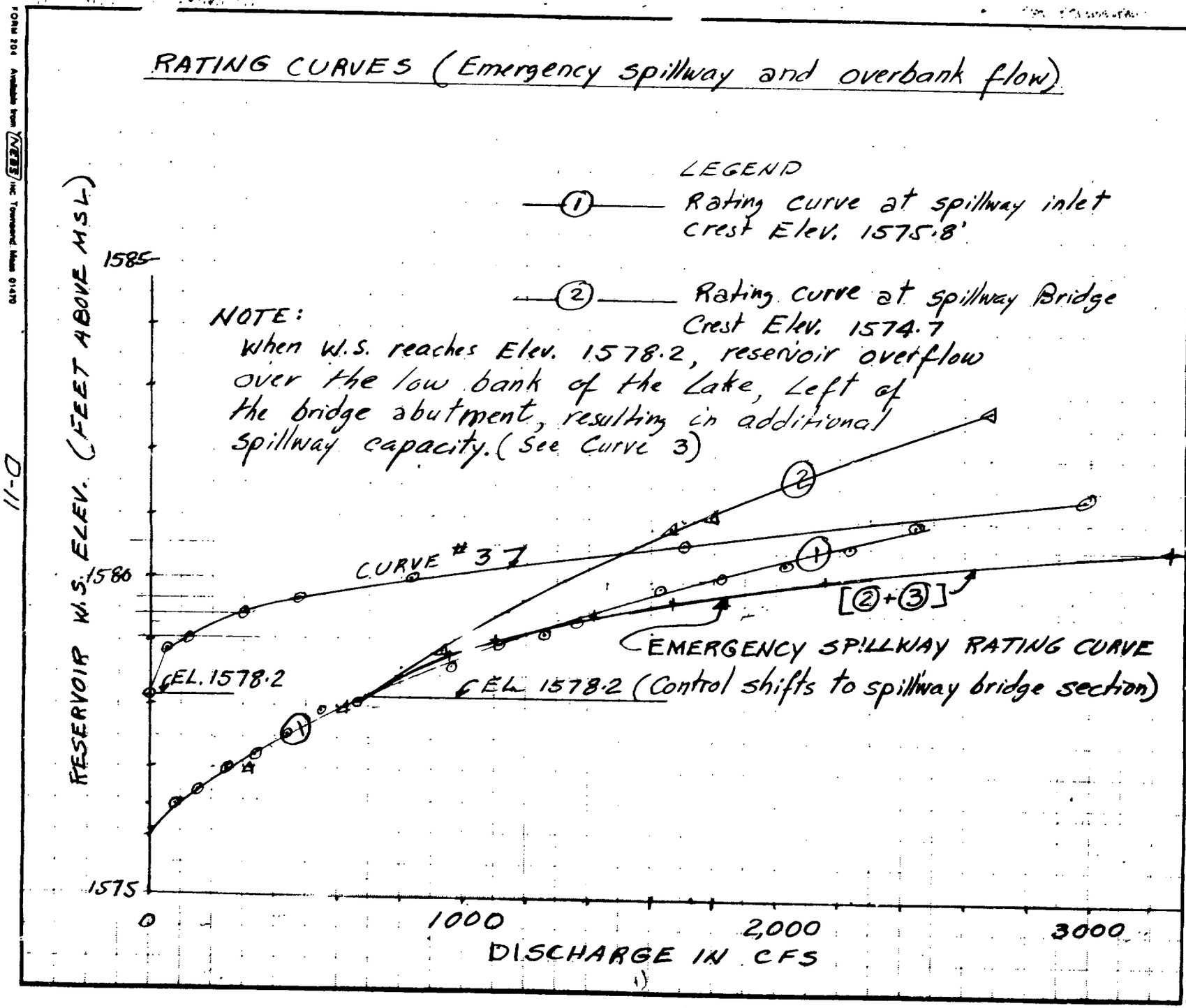
JOB _____ SHEET NO _____ OF _____

CALCULATED BY G.V. DATE 7/23/1981

CHECKED BY _____ DATE _____

MAPLE LAKE DAM

RATING CURVES (Emergency spillway and overbank flow)



GEO-TECHNICAL SERVICES
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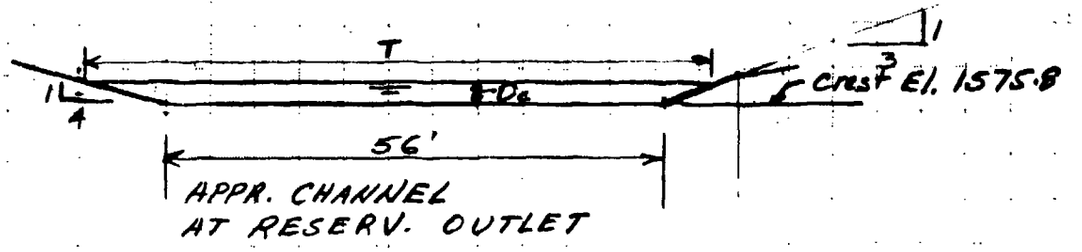
JOB
SHEET NO. OF
CALCULATED BY G.Y. DATE 7/23/1981
CHECKED BY DATE

MAPLE LAKE DAM

SPILLWAY RATING CURVE



For Control Section (at bridge - see sheet D-13)

For explanation of terms see also sheet D-15)

T is Top Width of water surface for a given critical depth De
a is the cross sectional area, for a given De, in ft²
$Hm = De + \frac{Dm}{2}$; W.S. Elev. = 1575.8 + Hm

De (1)	T (2)	a (3)	Dm = a/T (4)	$Q = a\sqrt{g\,Dm}$ (5)	Hm (6)	W.S. ELEV. (7)
0.2	57.4	11.34	0.197	28.6	0.30	1576.10
0.4	58.8	22.96	0.39	81.4	0.60	1576.40
0.6	60.2	34.86	0.58	150.5	0.89	1576.69
0.8	61.6	47.04	0.76	233.3	1.18	1576.98
1.0	63	59.5	0.94	328.1	1.47	1577.27
1.2	64.4	72.24	1.12	434	1.76	1577.56
1.4	65.8	85.26	1.30	550.7	2.05	1577.85
1.6	67.2	98.56	1.47	677.3	2.33	1578.13
2.0	70.0	126.00	1.80	959.3	2.90	1578.70
2.1	70.7	133.00	1.88	1036	3.04	1578.84
2.2	71.4	140.14	1.96	1114	3.18	1578.98

GEO-TECHNICAL SERVICES
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JOB
SHEET NO OF
CALCULATED BY GY DATE 7/23/1981
CHECKED BY DATE

MAPLE LAKE DAM

SPILLWAY RATING CURVES (CONT.)

SPILLWAY AT BRIDGE SECTION (See cross section, sheet D-14)

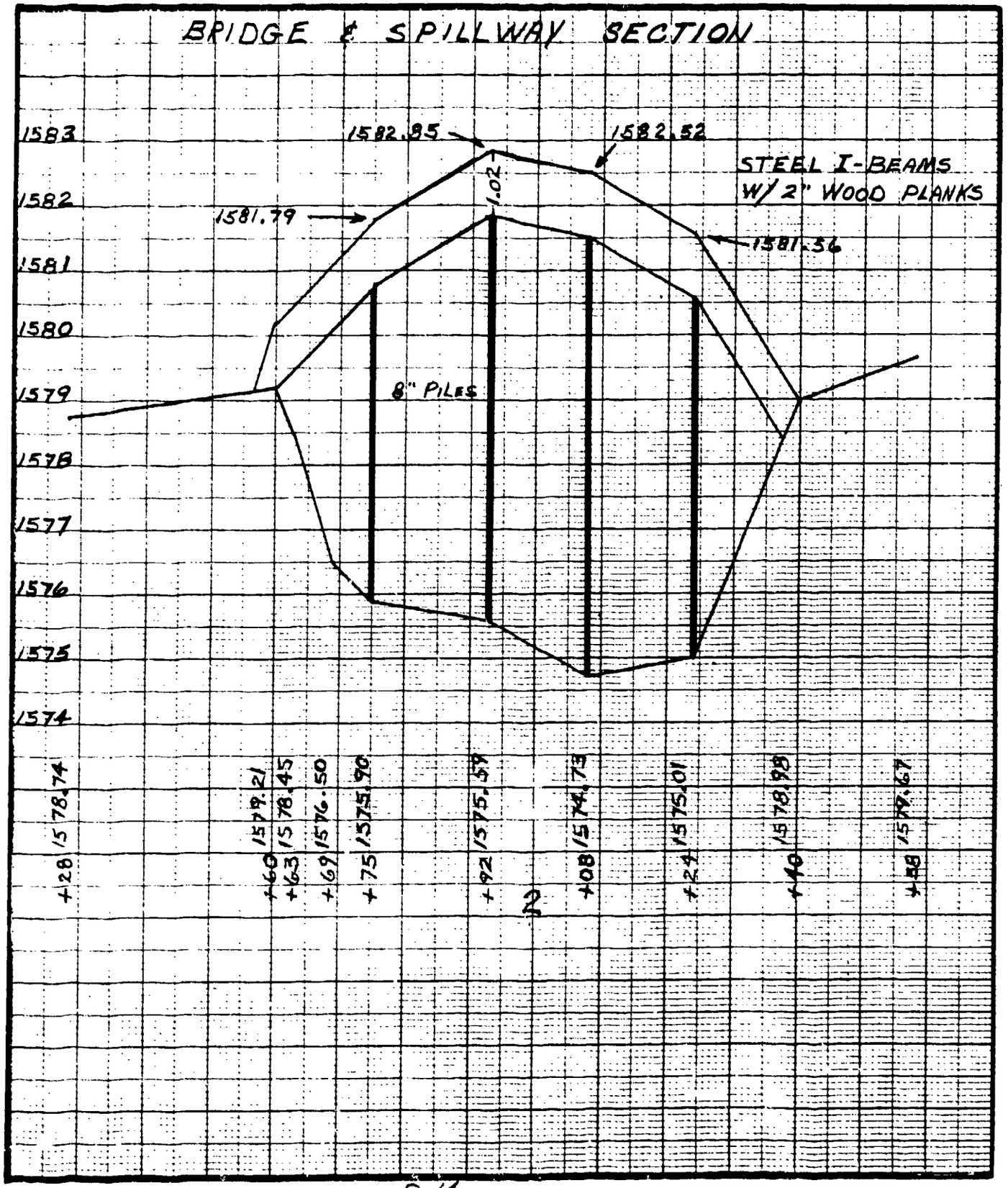
EL.	Dc	AREA (a) TOPWIDTH (T)	Dm = a/t	Q	Hm	W.S. ELEV *
1574.7	0			0		1574.70
1575.0	0.3	$20.67 \times 0.3/2 = 3.10\ ft^2$ $22 - 2 \times 0.667 = 20.67\ ft$	0.15	6.8	0.38	1575.08
1575.4	0.7	$3.10 + \frac{20.67+32}{2} \times 0.4 = 13.63\ ft^2$ $34 - 3 \times 0.667 = 32.0\ ft$	0.43	50.72	0.92	1575.84
1575.9	1.2	$13.63 + \frac{32+51}{2} \times 0.5 = 55.13\ ft^2$ $53 - 3 \times 0.667 = 51.0\ ft$	1.08	325.26	1.74	1576.98
1576.5	1.8	$55.13 + \frac{51.0+59.33}{2} \times 0.6 = 88.23\ ft^2$ $62 - 4 \times 0.667 = 59.33\ ft$	1.49	610.54	2.55	1577.99
1577.0	2.3	$88.23 + \frac{59.33+63.33}{2} \times 0.5 = 118.9\ ft^2$ $66 - 4 \times 0.667 = 63.33$	1.88	924.5	3.24	1578.88
1578.25	3.55	$118.9 + \frac{63.33+71.33}{2} \times 0.95 = 182.86\ ft^2$ $74 - 4 \times 0.667 = 71.33\ ft$	2.56	1,661.4	4.83	1580.81
1578.40	3.70	$182.86 + \frac{71.33+72.33}{2} \times 0.15 = 193.63$ $75 - 4 \times 0.667 = 72.33\ ft$	2.68	1,797.8	5.04	1581.08
1579.20	4.5	$193.63 + \frac{72.33+70.33}{2} \times 0.8 = 250.69$ $73 - 4 \times 0.667 = 70.33$	3.56	2,685.8	6.28	1582.76

Note: To account for velocity head in approach channel (see spillway section, Exhibit A-4) $V^2/2g$, assume $V = Q/a$

* W.S. ELEV = 1574.70 + Hm + Velocity head in approach channel

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

JOB [illegible]
SHEET NO _____ OF _____
CALCULATED BY RJM DATE 7-20-81
CHECKED BY _____ DATE _____
SCALE HORZ. 1" = 20' VERT. 1" = 2'

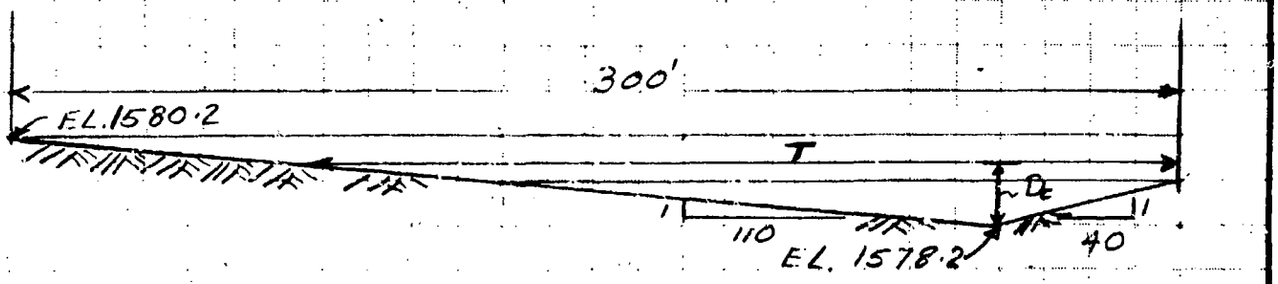


GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

JOB
SHEET NO. OF
CALCULATED BY GY DATE 7/23/1981
CHECKED BY DATE

MAPLE LAKE DAM

FLOW OVER LOW LAKESHORE BANK, LEFT ABUTMENT



Dc	T	a	Dm = a/T	Q = a√gDm	Hm	W.S. ELEV.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
0.5	75	18.75	0.25	53.2	0.63	1578.83
0.7	105	36.75	0.35	123.4	0.88	1579.08
1.0	150	75	0.50	301	1.25	1579.45
1.2	180	168	0.60	475	1.50	1579.70
1.5	225	168.75	0.75	829	1.88	1580.08
2.0	300	300	1.00	1702	2.50	1580.70
2.5	375	468.75	1.25	2974	3.13	1581.33
3.0	450	675	1.50	4691	3.75	1581.95

(2) for $0 < Dc < 2.0$ $T = 150 \times Dc$; For $Dc > 2.0$ $T = 300'$

(3) a = area (ft^2)
for $0 < Dc < 2.0$ $a = T \times Dc/2$ ft^2
for $Dc > 2.0$ $a = 300 + (Dc - 2.0) \times T$

(6) $Hm = Dc + \frac{Dm}{2}$; (7) W.S. EL. = 1578.2 + Hm

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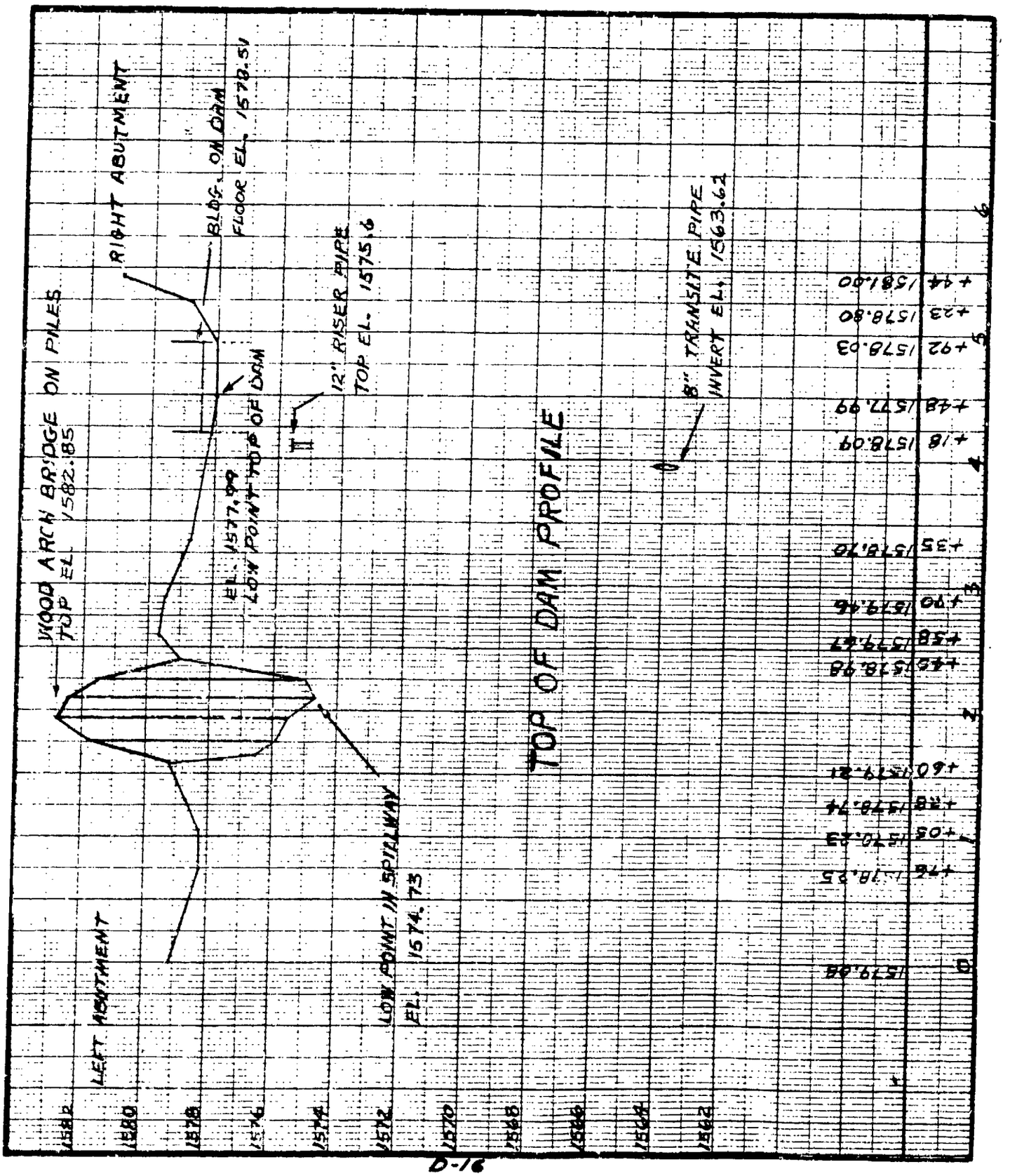
JOB MAPLE LAKE
SHEET NO 1 OF 1
CALCULATED BY RJM DATE 7-20-81
CHECKED BY DATE
SCALE HORZ. 1"=100' VERT. 1"=4'



GEO-TECHNICAL SERVICES
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JOB
SHEET NO ____ OF ____
CALCULATED BY G.Y DATE 7/24/1981
CHECKED BY ____ DATE ____
SCALE MAPLE LAKE DAM

RESERVOIR STORAGE

W.S. ELEV.	AREA ACRES	STORAGE AC-FT	REMARKS
1561.2*	0	0	From Computations by the Conic Method
1575.6	16.0**	76.7**	Normal pool Elev. **
1578.0	17.2	126.5***	Low point on crest
1580.0	18		by planimeter of contour
1590.0	27		by planimeter of contour

* Bottom elevation of truncated cone (for HEC-1 DB)
$1575.6 - \frac{3 \times 76.7}{16} = 1575.6 - 14.4$ El. 1561.2

** From 1953 Design Dwgs (Note: EL 1575.6, Existing condition ≡ EL. 1575.6 of design drawings) and revised as per permit application. Also, as reported in Bulletin No. 5.

*** EL. 1575.6 < ΔV < EL 1578; $\Delta V = \frac{2.4}{3}(16.0 + 17.2 + \sqrt{16 \times 17.2}) = 49.8$ ac-ft
Storage at EL. 1578 = 76.7 + 49.8 = 126.5 ac-ft

GEO-TECHNICAL SERVICES
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McCARTY LAKE (UPSTREAM OF MAPLE LAKE)

DRAINAGE BASIN & UNIT HYDROGRAPH DATA

DRAINAGE AREA 0.09 Sq. Mi.

SNYDER UNIT HYDROGRAPH COEFFICIENTS
AS SUPPLIED BY BALT. DIST. COE (SUSQUEHANNA BASIN ZONE 17)

$C_p = 0.45$
$C_t = 1.13$

LAG TIME = $T_p = C_t (L \times L_{ca})^{0.3}$

L = 0.33 mi. RESERVOIR OUTLET TO DRAINAGE DIVIDE
L_{ca} = 0.17 mi. RESERVOIR OUTLET TO CENTROID

$\therefore T_p = 1.13(0.33 \times 0.17)^{0.3} = 0.48$ Hrs

RAINFALL DATA

SAME AS MAPLE LAKE

RAINFALL DISTRIBUTION

SAME AS MAPLE LAKE

McCARTY LAKE (CONT.)

DAM DATA

TOP OF DAM ELEV. (LOW POINT)	1663.0
DAM LENGTH (INC. FILLED SPILLWAY)	650'
"C" VALUE - DAM	2.7
NON-LEVEL DAM	

LENGTH OF DAM	BELOW ELEV.
0'	1663.0
300'	1663.1
650'	1665.1
1200'	1680.0

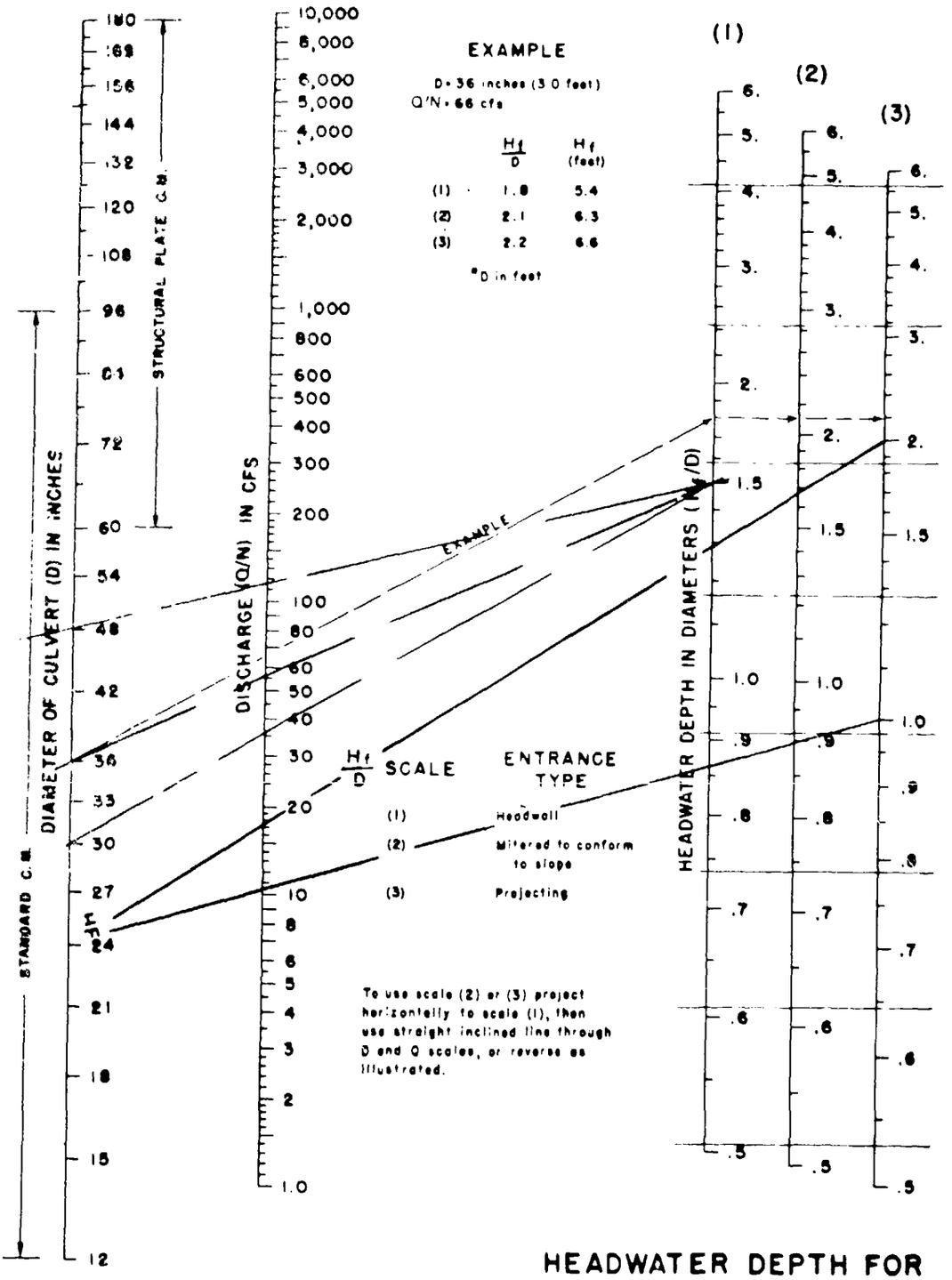
SPILLWAY DATA

ORIGINAL EMERGENCY SPILLWAY HAS BEEN BACKFILLED & REPLACED WITH A 24"Ø CMP
ASSUME INLET CONTROL

HW	HW/D	Q*	
0	0	0 cfs	ELEV. 1661.5
2'	1	10 cfs	1663.5
4.1'	2	17 cfs	1665.6

* See Sheet D-20

Chart 12



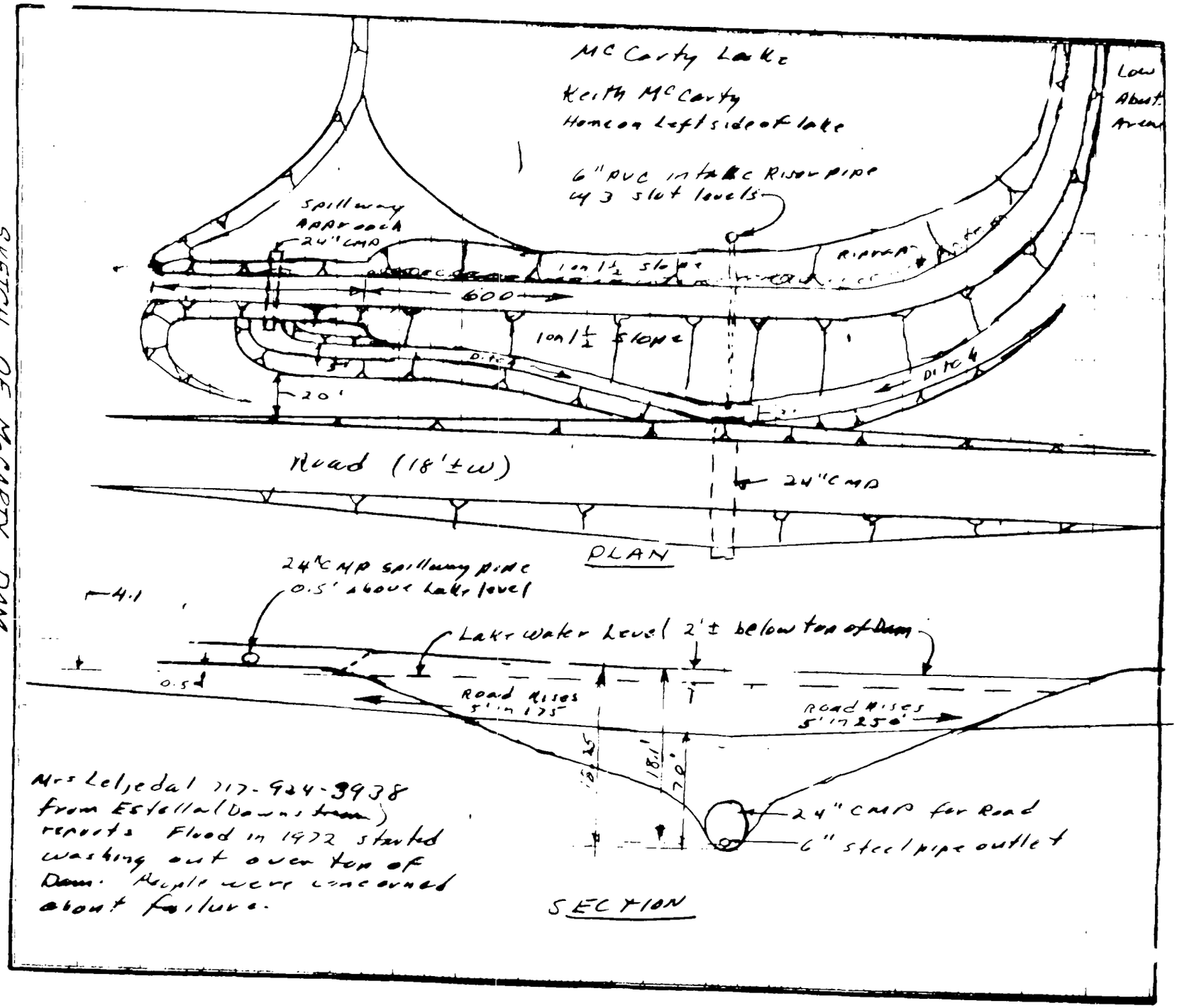
HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

FEDERAL HIGHWAY ADMINISTRATION
MAY 1973

13-76

1.-0

SKETCH OF MCCARTY DAM



Mrs Leljedal 717-924-3938
from Estella (Downstream)
reports Flood in 1972 started
washing out over top of
Dam. People were concerned
about failure.

GEO-TECHNICAL SERVICES
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McCARTY LAKE (CONT.)

ASSUME BOTTOM @ ELEV. 1645.0
AREA @ NORMAL POOL = 6.5 Ac (ELEV. 1661)
AREA @ 1680 CONTOUR = 21.1 Ac
∴ AREA @ LOW POINT = $6.5 + (14.6/19)(2) = 8.0$ Ac

ELEV.	AREA	
1645.0	0	BOTTOM RESERVOIR
1661.0	6.5	NORMAL
1663.0	8.0	LOW POINT TOP OF DAM
1680.0	21.1	CONTOUR

GEO-TECHNICAL SERVICES
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JOB MAPLE LAKE 1-A-1026
SHEET NO ____ OF ____
CALCULATED BY MEH DATE 7/29/81
CHECKED BY ____ DATE ____
SCALE ____

TYPICAL SECTION FOR ROUTING McCARTY LAKE OUTFLOW TO MAPLE LAKE.

STA.	ELEV.
0	1586.3
50	1583.0
100	1579.6
103	1575.6
107	1575.6
110	1579.6
160	1583.0
210	1586.3

REACH LENGTH = 4600'
SLOPE = 0.0151 %

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********
    1                 A1       NATIONAL DAM INSPECTION PROGRAM
    2                 A2       MAPLE LAKE--PA1026 (OVERTOPPING ANALYSIS)
    3                 A3       ELKLAND TWP,  SULLIVAN CO,  PA
    4                 B     150        0        15         0         0         0         0        -4         0
    5                 B1      5        0         0         0         0         0         0         0         0
    6                 J       1        7         1         0         0         0         0         0         0
    7                 J1     .1       .2        .3        .4        .5       .75         1         0         0
    8                 W       0        1         0         0         0         0         1         0         0
    9                 K1       INFLOW TO MCCARTY LAKE (SUB-AREA 1)
   10                 M       1        1      0.09         0      0.62         0         0         0         1
   11                 P       0     22.0       118       127       136       142         0         0         0
   12                 T       0        0         0         0         0         0         1       .05         0
   13                 W    0.48     0.45         0         0         0         0         0         0         0
   14                 X    -1.5     -.05         2         0         0         0         0         0         0
   15                 K       1        2         0         0         0         0         1         0         0
   16                 K1       ROUTE THRU MCCARTY LAKE
   17                 Y       0        0         0         1         1         0         0         0         0
   18                 Y1      1        0         0         0         0         0     -1661        -1         0
   19                 Y41661.5  1663.5  1665.6         0         0         0         0         0         0
   20                 Y5      0       10        17         0         0         0         0         0         0
   21                 $A      0      6.5       8.0      21.1         0         0         0         0         0
   22                 $E   1645     1661      1663      1680         0         0         0         0         0
   23                 $$1661.5         0         0         0         0         0         0         0         0
   24                 $D   1663      2.7       1.5       648         0         0         0         0         0
   25                 $L      0      300       650      1200         0         0         0         0         0
   26                 $V1663.0  1663.1  1665.1      1680         0         0         0         0         0
   27                 K       1        3         0         0         0         0         1         0         0
   28                 K1       ROUTE TO MAPLE LAKE
   29                 Y       0        0         0         1         1         0         0         0         0
   30                 Y1      1        0         0         0         0         0         0         0         0
   31                 Y6    .08      .04       .08    1575.6      1600      4600    0.0151         0         0
   32                 Y7      0   1586.3        50    1583.0       100    1579.6       103    1575.6       107    1575.6
   33                 Y7    110   1579.6       160    1583.0       210    1586.3         0         0         0         0
   34                 K       0        3         0         0         0         0         1         0         0         0
   35                 K1       INFLOW FROM SUB-AREA 2
   36                 M       1        1      0.53         0      0.62         0         0         0         1         0
   37                 P       0     22.0       118       127       136       142         0         0         0         0
   38                 T       0        0         0         0         0         0         1       .05         0         0
   39                 W    1.08     0.45         0         0         0         0         0         0         0         0
   40                 X    -1.5     -.05         2         0         0         0         0         0         0         0
   41                 K       2        3         0         0         0         0         1         0         0         0
   42                 K1       INFLOW TO MAPLE LAKE
   43                 K       1        4         0         0         0         0         1         0         0         0
   44                 K1       ROUTE THRU MAPLE LAKE
   45                 Y       0        0         0         1         1         0         0         0         0         0
   46                 Y1      1        0         0         0         0         0   -1575.6        -1         0         0
   47                 Y41575.6  1575.8  1576.1  1576.4  1577.0  1578.0  1578.2  1578.8  1579.0  1580.0
   48                 Y41581.0  1582.0         0         0         0         0         0         0         0         0
   49                 Y5      0      0.9        32        85       264       624       704       957      1255      2145
   50                 Y5   3810     6956         0         0         0         0         0         0         0         0
```

51		$A 0	16.0	17.0	19	27	0	0	0	0	0
52		$$1561.2	1575.6	1578.0	1580.0	1590.0	0	0	0	0	0
53		$$1575.6	0	0	0	0	0	0	0	0	0
54		$D1578.0	2.7	1.5	280	0	0	0	0	0	0
55		$L 0	42	185	205	253	292	295	303	0	0
56		$V1578.0	1578.1	1578.7	1579.0	1579.4	1579.6	1580	1581	0	0
57		K 99	0	0	0	0	0	0	0	0	0

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********

RUN  DATE= 81/07/31.
     TIME= 07.46.10.
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NATIONAL DAM INSPECTION PROGRAM
MARLE LAKE--PA1026 (OVERTOPPING ANALYSIS)
ELKLAND TWP, SULLIVAN CO, PA

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	15	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTID= 7 LRTID= 1

RTIOS= .10 .20 .30 .40 .50 .75 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW TO MCCARTY LAKE (SUB-AREA 1)

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.09	0.00	.62	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.00	118.00	127.00	136.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= .48 CP= .45 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 16 END-OF-PERIOD ORDINATES, LAG= .48 HOURS, CP= .45 VOL= 1.00

18.	47.	50.	35.	24.	17.	12.	8.	6.	4.
3.	2.	1.	1.	1.	0.				

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	24.99	22.74	2.25	5288.
										(635.)	(578.)	(57.)	(149.74)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE THRU MCCARTY LAKE

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	6	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1661.	-1

STAGE	1661.50	1663.50	1665.60	
FLOW	0.00	10.00	17.00	
SURFACE AREA=	0.	7.	8.	21.
CAPACITY=	0.	35.	49.	288.
ELEVATION=	1645.	1661.	1663.	1680.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1661.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1663.0	2.7	1.5	646.

CREST LENGTH	0.	309.	650.	1200.
AT OR BELOW ELEVATION	1663.0	1663.1	1665.1	1680.0

PEAK OUTFLOW IS 4. AT TIME 43.25 HOURS

PEAK OUTFLOW IS 36. AT TIME 41.75 HOURS

PEAK OUTFLOW IS 102. AT TIME 40.50 HOURS

PEAK OUTFLOW IS 158. AT TIME 40.25 HOURS

PEAK OUTFLOW IS 199. AT TIME 40.25 HOURS

PEAK OUTFLOW IS 202. AT TIME 40.25 HOURS

PEAK OUTFLOW IS 404. AT TIME 40.25 HOURS

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE TO MAPLE LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ROUTING DATA

GLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0400	.0800	1575.5	1600.0	4600.	.01510

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1586.30 50.00 1583.00 100.00 1579.60 103.00 1575.60 107.00 1575.60
110.00 1579.60 160.00 1583.00 210.00 1586.30

STORAGE	0.00	.67	1.61	2.80	6.16	14.62	28.19	47.01	71.09	99.28
	127.76	156.24	184.72	213.20	241.68	270.16	298.64	327.11	355.59	384.07
OUTFLOW	0.00	26.87	89.69	189.45	388.82	798.46	1524.19	2656.48	4282.11	6763.37
	9941.98	13626.58	17783.48	22386.61	27414.88	32850.77	38679.33	44887.61	51464.24	58399.09
STAGE	1575.60	1576.86	1578.17	1579.45	1580.74	1582.02	1583.31	1584.59	1585.87	1587.16
	1588.44	1589.73	1591.01	1592.29	1593.58	1594.86	1596.15	1597.43	1598.72	1600.00
FLOW	0.00	26.87	89.69	189.45	388.82	798.46	1524.19	2656.48	4282.11	6763.37
	9941.98	13626.58	17783.48	22386.61	27414.88	32850.77	38679.33	44887.61	51464.24	58399.09

MAXIMUM STAGE IS 1575.8

MAXIMUM STAGE IS 1577.0

MAXIMUM STAGE IS 1578.2

MAXIMUM STAGE IS 1579.0

MAXIMUM STAGE IS 1579.5

MAXIMUM STAGE IS 1580.0

MAXIMUM STAGE IS 1580.6

********** *********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW FROM SUB-AREA 2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHY	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.53	0.00	.62	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.00	118.00	127.00	136.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSHX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 1.08 CP= .45 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 40 END-OF-PERIOD ORDINATES, LAG= 1.08 HOURS, CP= .45 VOL= 1.00

13.	49.	94.	130.	139.	127.	110.	95.	82.	71.
62.	53.	46.	40.	34.	30.	26.	22.	19.	17.
14.	13.	11.	9.	8.	7.	6.	5.	5.	4.
3.	3.	3.	2.	2.	2.	1.	1.	1.	1.

0

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	24.99	22.74	2.25	30462.
										(635.)	(578.)	(57.)	(862.59)

********** *********** ********** ********** **********

COMBINE HYDROGRAPHS

INFLOW TO MAPLE LAKE

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	2	0	0	0	0	1	0	0

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE THRU MAPLE LAKE

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1576.	-1

STAGE	1575.60	1575.80	1576.10	1576.40	1577.00	1578.00	1578.20	1578.80	1579.00	1580.00
	1581.00	1582.00								
FLOW	0.00	.00	32.00	85.00	264.00	624.00	704.00	957.00	1255.00	2145.00
	3819.00	6956.00								
SURFACE AREA=	0.	16.	17.	18.	27.					
CAPACITY=	0.	77.	117.	152.	375.					
ELEVATION=	1561.	1576.	1578.	1580.	1590.					

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1575.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1578.0	2.7	1.5	280.

CREST LENGTH	0.	42.	185.	205.	253.	292.	295.	303.
AT CR BELOW ELEVATION	1578.0	1578.1	1578.7	1579.0	1579.4	1579.6	1580.0	1581.0

PEAK OUTFLOW IS 136. AT TIME 41.75 HOURS

PEAK OUTFLOW IS 287. AT TIME 41.75 HOURS

PEAK OUTFLOW IS 489. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 674. AT TIME 41.25 HOURS

PEAK OUTFLOW IS 878. AT TIME 41.00 HOURS

PEAK OUTFLOW IS 1430. AT TIME 40.75 HOURS

PEAK OUTFLOW IS 1884. AT TIME 40.75 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .10	RATIO 2 .20	RATIO 3 .30	RATIO 4 .40	RATIO 5 .50	RATIO 6 .75	RATIO 7 1.00
HYDROGRAPH AT	1	.09	1	40.	80.	120.	160.	200.	299.	399.
	(	.23)	(	1.13)(	2.26)(	3.39)(	4.52)(	5.65)(	8.48)(	11.30)(
ROUTED TO	2	.09	1	4.	36.	102.	158.	199.	302.	404.
	(	.23)	(	.12)(	1.01)(	2.89)(	4.46)(	5.64)(	8.54)(	11.45)(
ROUTED TO	3	.09	1	4.	34.	92.	151.	190.	281.	375.
	(	.23)	(	.12)(	.96)(	2.61)(	4.27)(	5.38)(	7.95)(	10.62)(
HYDROGRAPH AT	3	.53	1	155.	310.	465.	621.	776.	1164.	1552.
	(	1.37)	(	4.39)(	8.79)(	13.18)(	17.57)(	21.97)(	32.95)(	43.93)(
2 COMBINED	3	.62	1	157.	316.	558.	758.	946.	1421.	1892.
	(	1.61)	(	4.45)(	8.96)(	15.79)(	21.45)(	26.79)(	40.25)(	53.62)(
ROUTED TO	4	.62	1	136.	287.	489.	674.	878.	1330.	1884.
	(	1.61)	(	3.85)(	8.12)(	13.84)(	19.10)(	24.86)(	40.50)(	53.35)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1661.00	1661.50	1663.00
STORAGE	35.	38.	49.
OUTFLOW	0.	0.	8.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1662.34	0.00	44.	4.	0.00	43.25	0.00
.20	1663.15	.15	50.	36.	4.00	41.75	0.00
.30	1663.26	.26	51.	102.	5.25	40.50	0.00
.40	1663.34	.34	52.	158.	6.50	40.25	0.00
.50	1663.39	.39	52.	199.	8.00	40.25	0.00
.75	1663.49	.49	53.	302.	10.00	40.25	0.00
1.00	1663.58	.58	54.	404.	10.50	40.25	0.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	4.	1575.8	43.50
.20	34.	1577.0	42.00
.30	92.	1578.2	40.75
.40	151.	1579.0	40.50
.50	190.	1579.5	40.50
.75	281.	1580.0	40.50
1.00	375.	1580.6	40.50

SUMMARY OF DAM SAFETY ANALYSIS

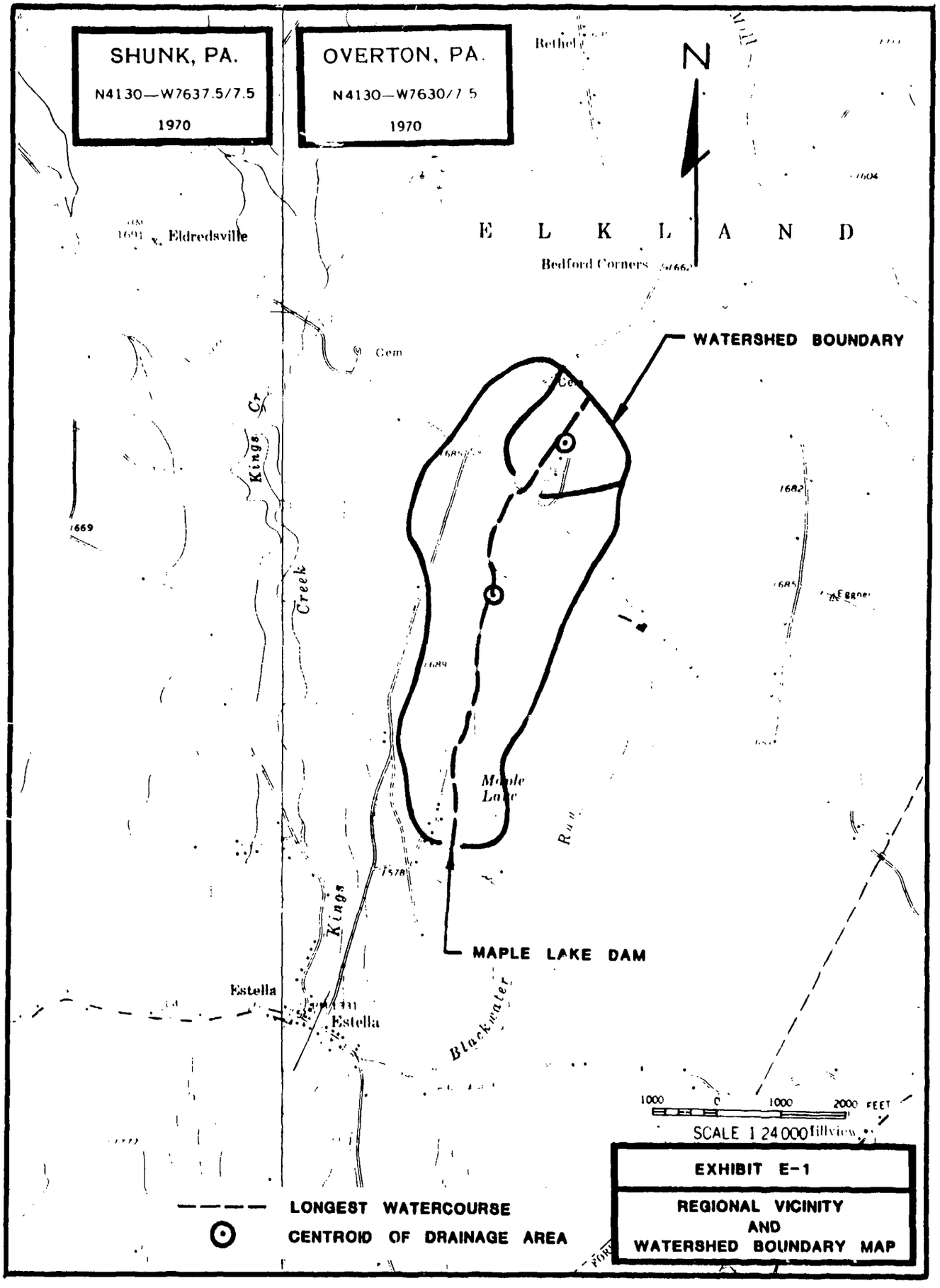
PLAN 1 .....

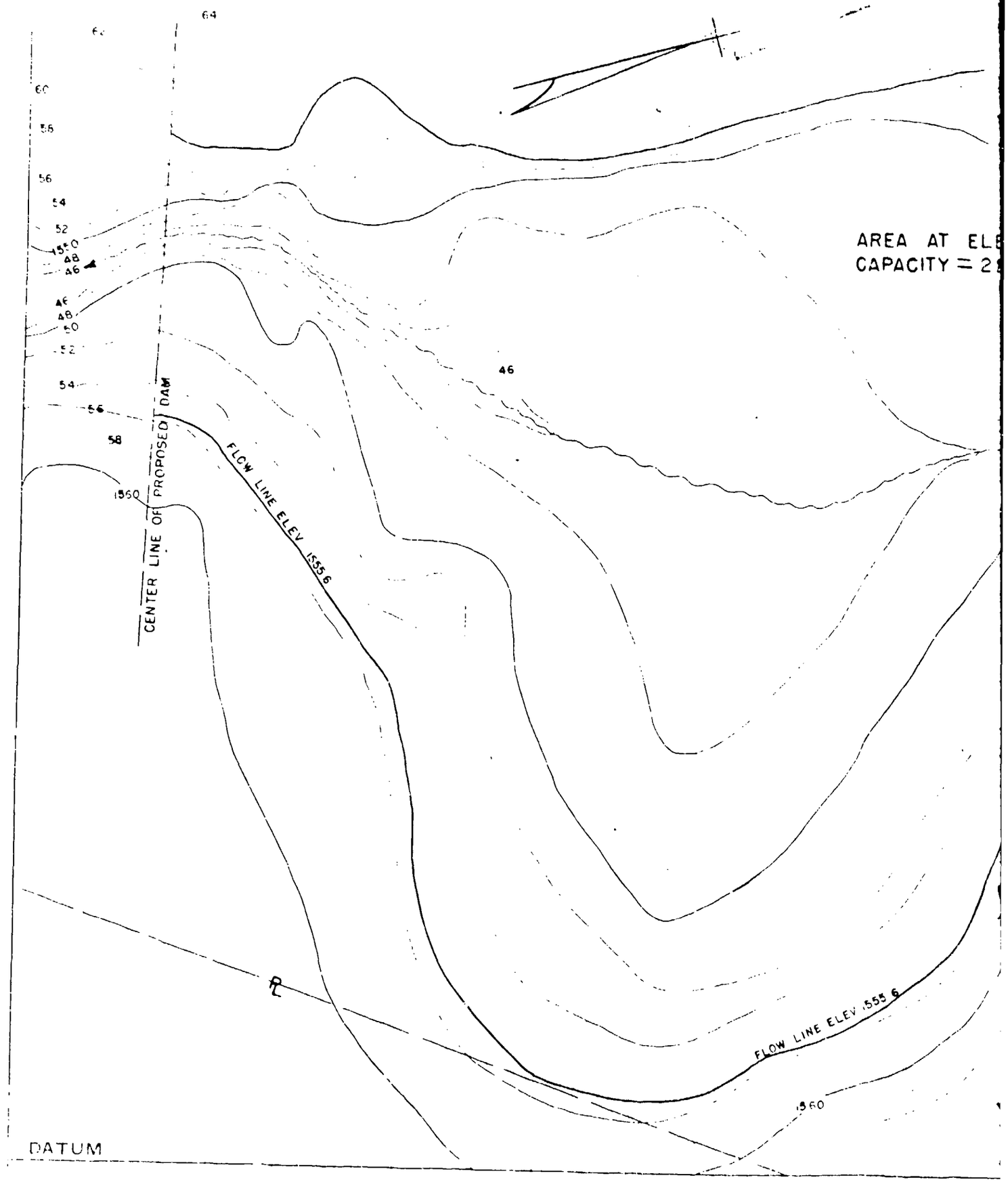
	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1575.60	1575.60	1578.00
STORAGE	77.	77.	117.
OUTFLOW	0.	0.	624.

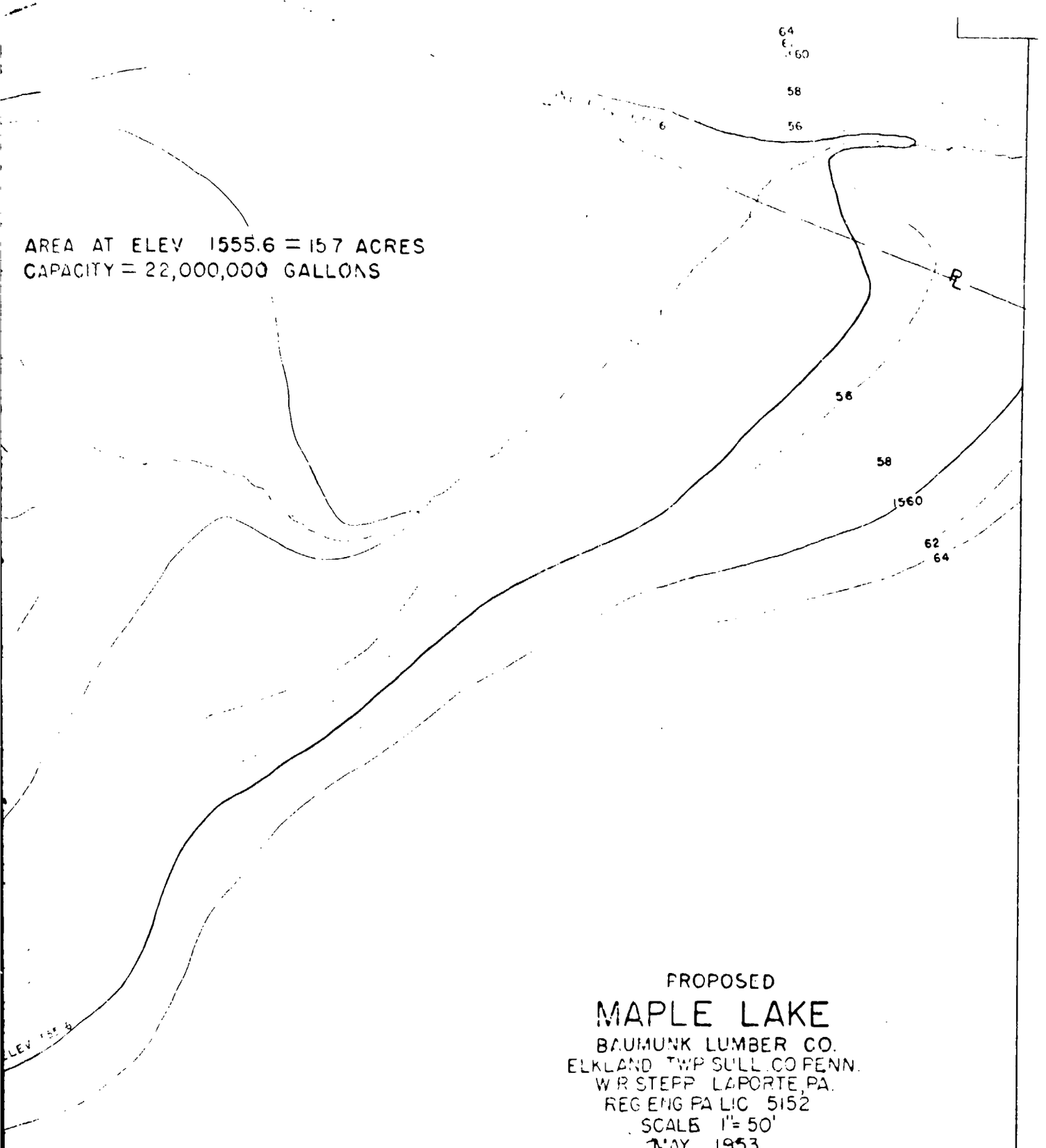
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1576.57	0.00	93.	136.	0.00	41.75	0.00
.20	1577.06	0.00	101.	287.	0.00	41.75	0.00
.30	1577.62	0.00	110.	489.	0.00	41.50	0.00
.40	1578.12	.12	119.	674.	1.00	41.25	0.00
.50	1578.47	.47	125.	878.	2.50	41.00	0.00
.75	1578.93	.93	133.	1430.	4.00	40.75	0.00
1.00	1579.18	1.18	137.	1884.	5.25	40.75	0.00

APPENDIX E

EXHIBITS


SHUNK, PA.
N4130—W7637.5/7.5
1970
OVERTON, PA.
N4130—W7630/7.5
1970
N
E L K L A N D
Bethel
Eldredsville
Bedford Corners
WATERSHED BOUNDARY
Kings Cr
Creek
Maple Lake
MAPLE LAKE DAM
Kings
Estella
Estella
Blackwater
1000 0 1000 2000 FEET
SCALE 1:24000
Hillview
LONGEST WATERCOURSE
CENTROID OF DRAINAGE AREA
EXHIBIT E-1
REGIONAL VICINITY
AND
WATERSHED BOUNDARY MAP


64
60
56
56
54
52
1550
48
46
46
48
50
52
54
56
58
1560
46
AREA AT EL
CAPACITY = 2
CENTER LINE OF PROPOSED DAM
FLOW LINE ELEV 1555.6
FLOW LINE ELEV 1555.6
1560
DATUM



AREA AT ELEV 1555.6 = 157 ACRES
CAPACITY = 22,000,000 GALLONS

PROPOSED

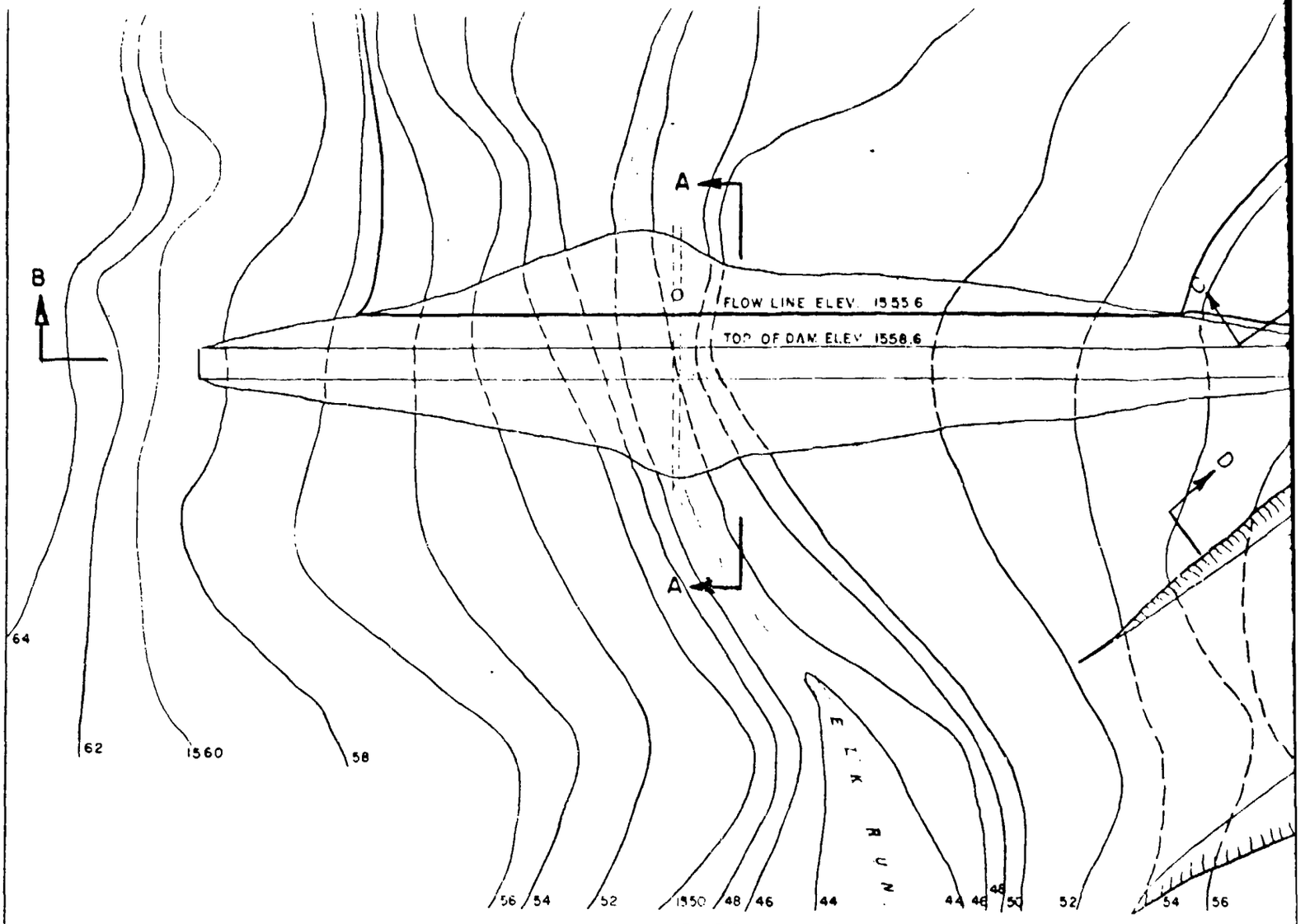
MAPLE LAKE

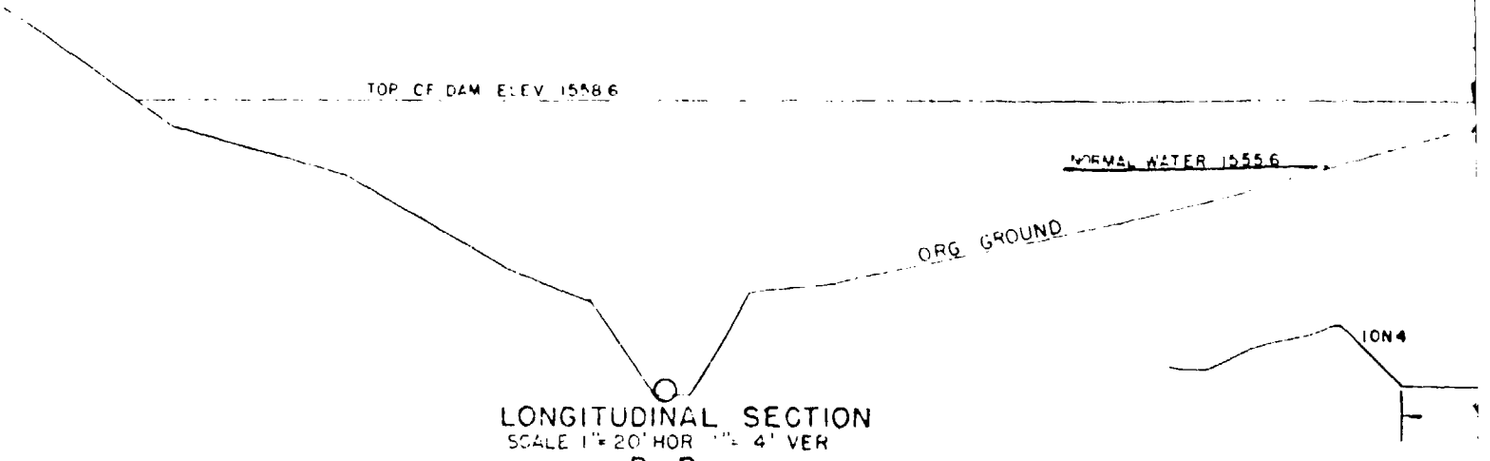
BAUMUNK LUMBER CO.
ELKLAND TWP SULL. CO PENN.
W R STEPP LAPORTE, PA.
REG ENG PA LIC 5152
SCALE 1" = 50'
MAY 1953
SHEET 1 OF 4
PLAN

2

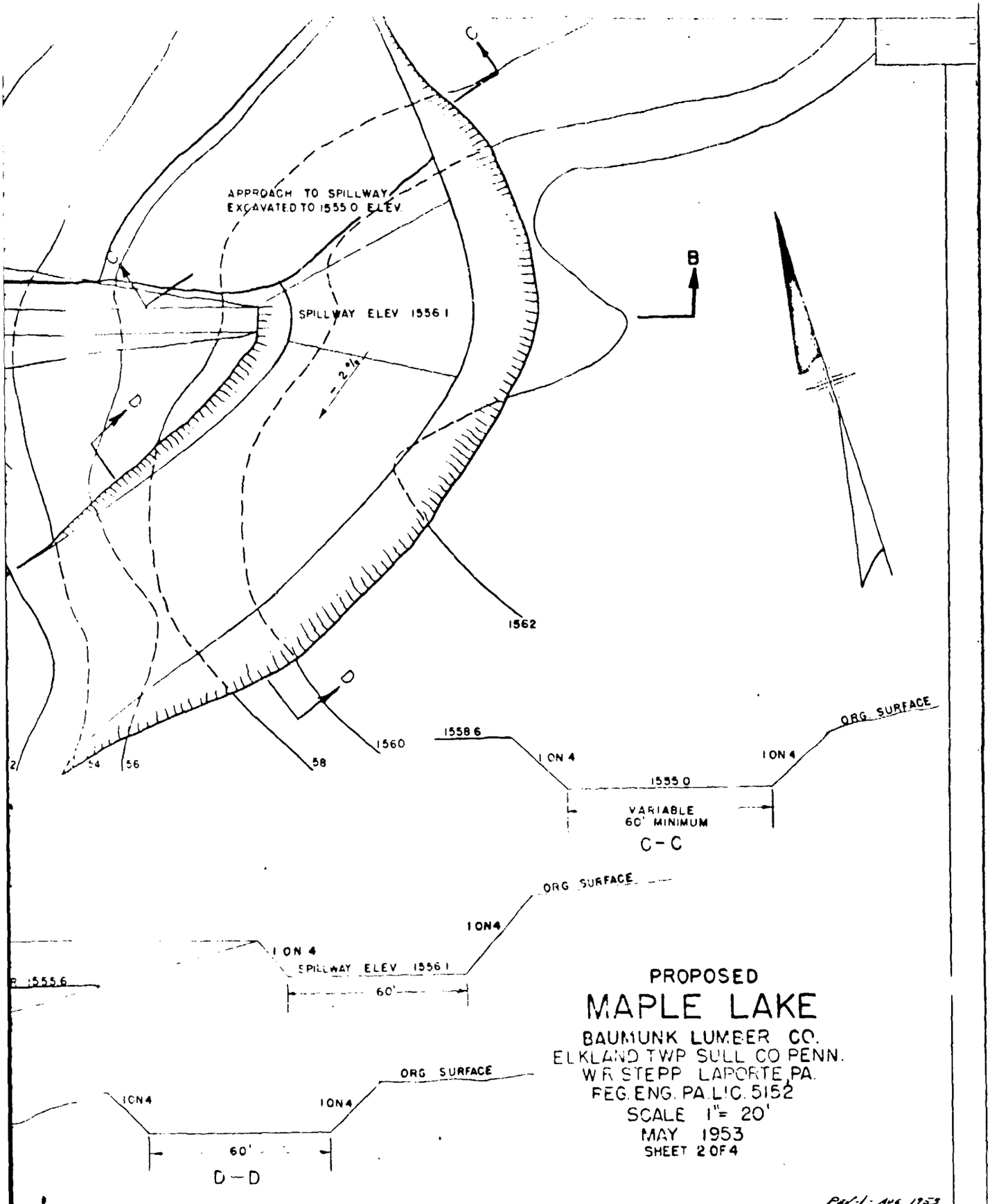
Rev-1-Nov. 1953

EXHIBIT E-2


A
B
A
B
C
D
FLOW LINE ELEV. 1555.6
TOP OF DAM ELEV. 1558.6
64
62
1560
58
56
54
52
1550
48
46
44
44
46
48
50
52
54
56
N
GENERAL PLAN


TOP OF DAM ELEV 1558.6
NORMAL WATER 1555.6
ORG GROUND
LONGITUDINAL SECTION
SCALE 1"=20' HOR 1"= 4' VER
B-B

DATUM USGS



PROPOSED

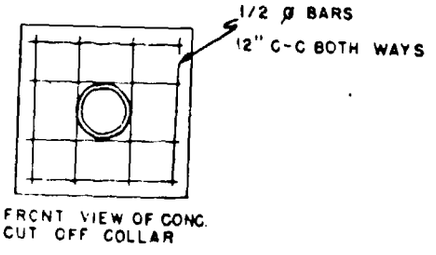
MAPLE LAKE

BAUMUNK LUMBER CO.
ELKLAND TWP SULL CO PENN.
W R STEPP LAPORTE, PA.
REG. ENG. PA. LIC. 5152
SCALE 1" = 20'
MAY 1953
SHEET 2 OF 4

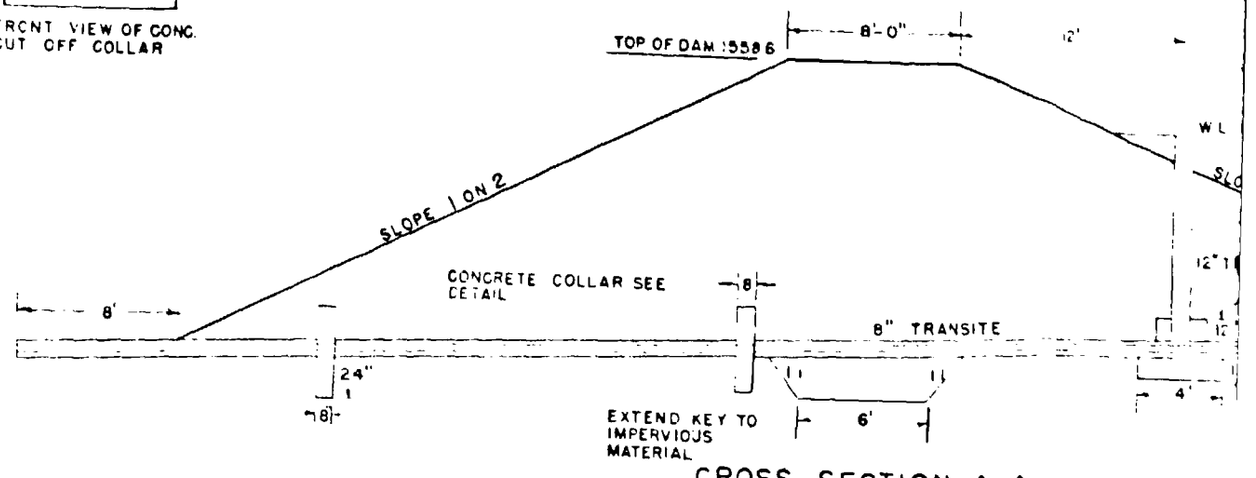
Rev. 1 - Aug 1953

2

EXHIBIT E-8

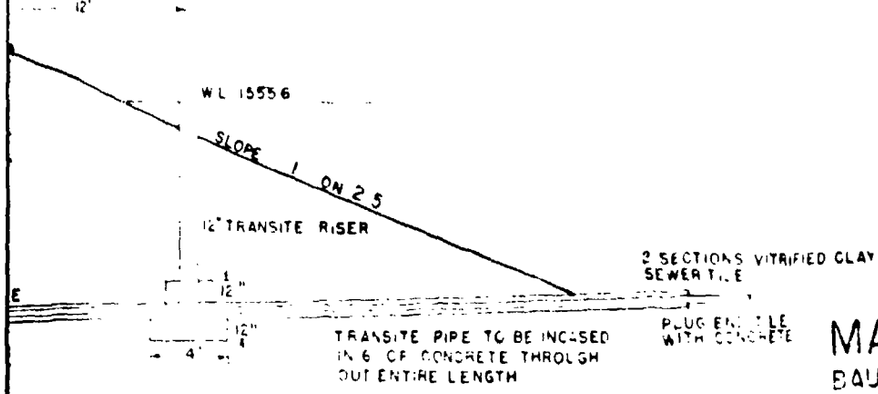


FRONT VIEW OF CONC. CUT OFF COLLAR



CROSS SECTION A-A

DATUM



PROPOSED

MAPLE LAKE

BAUMUNK LUMBER CO.
ELKLAND TWP SULL. CO. PENN.
W. R. STEPP LAPORTE, PA
REG. ENG. PA. LIC. 5152
SCALE 1" = 4'
MAY 1953
SHEET 3 OF 4

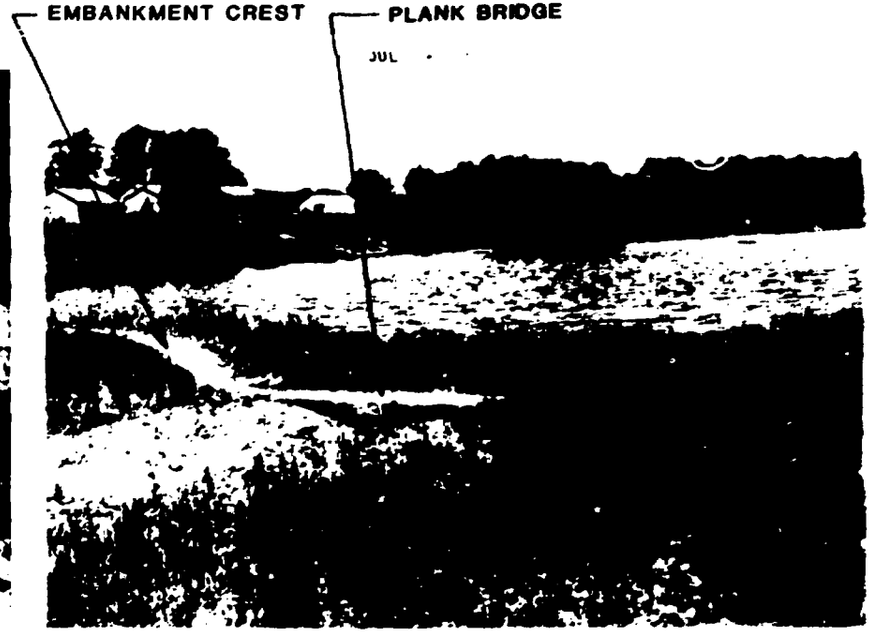
REV-1- AUG 1953

EXHIBIT E-4

VIEW FROM RIGHT ABUTMENT

UPSTREAM FACE AT NORMAL POOL (7/6/1965)

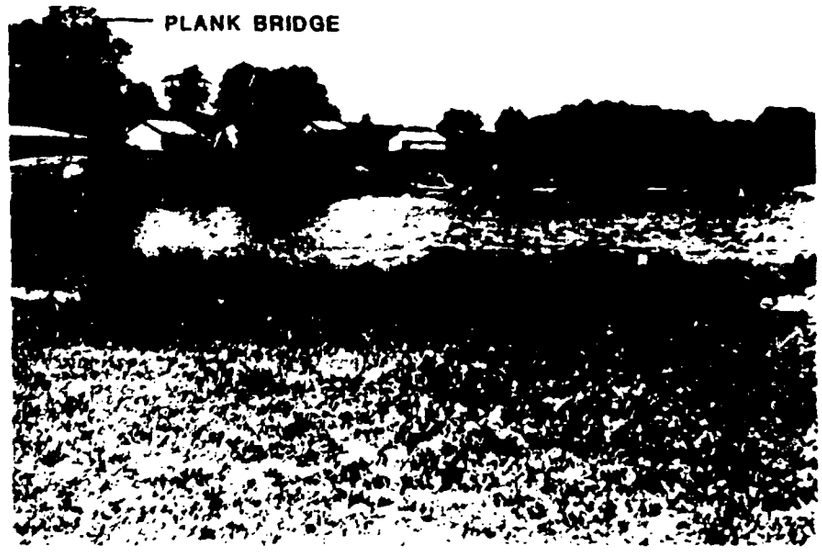
VIEW FROM LEFT ABUTMENT UPSTREAM FACE OF DAM (AUG. 1954)



UPSTREAM VIEW OF EMERGENCY SPILLWAY CONDITIONS IN JULY, 1965

EXHIBIT E-6

EXCAVATED EMERGENCY SPILLWAY (8/10/1954)



UPSTREAM VIEW OF LAKE (7/06/1965)
EMERGENCY SPILLWAY LEFT BANK IN FOREGROUND

PRIOR REMOVAL OF TREES (7/06/1965)

AFTER REMOVAL OF TREES (9/23/1965)

EXHIBIT E-6

APPENDIX F

GEOLOGY

MAPLE LAKE DAM

APPENDIX F

GEOLOGY

The Maple Lake Dam and reservoir area are located within the Glaciated Allegheny Plateau Section of the Appalachian Plateau Physiographic Province. Except where bedrock is exposed, deposits of glacial drift of variable thickness cover much of the area. The drift was deposited by the Wisconsin Ice Sheet during the Pleistocene period of geologic time.

The glacial drift is composed primarily of till which is a reddish-brown, unsorted, compact mixture of clay, silt, sand, gravel, and cobbles with occasional boulder sized pieces. The stone pieces are sub-angular to rounded and consist mainly of sandstone and siltstone derived from the Catskill Formation, the dominant rock formation in the area. The clay content and compact nature of the till makes it a relatively impervious soil type.

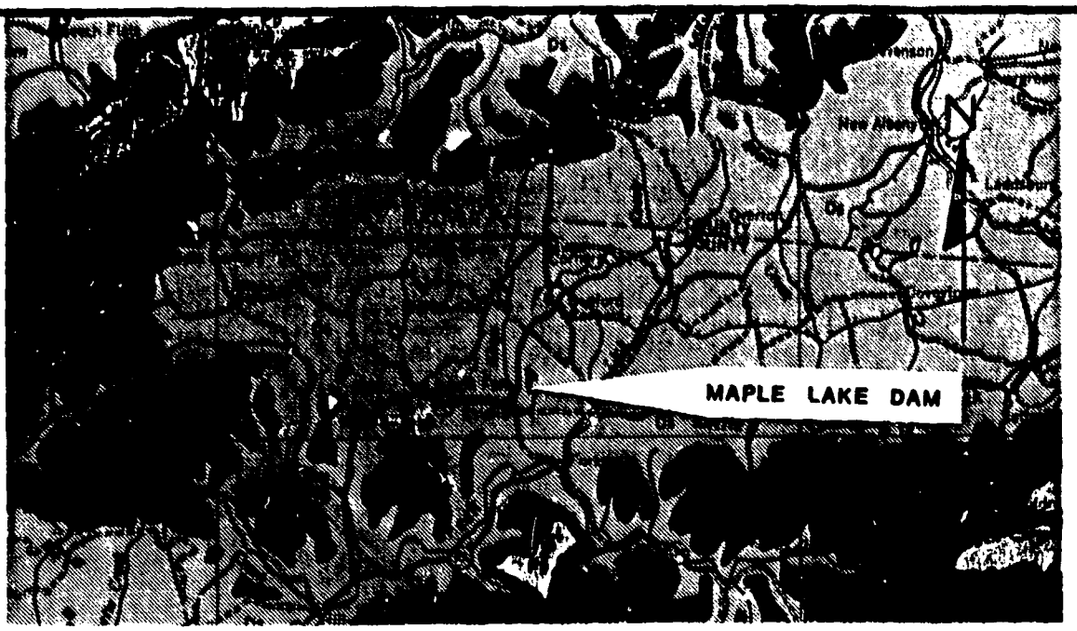
Some deposits of glacial outwash and Kame terraces are also found in the area. These deposits are composed of loose, poorly sorted to stratified deposits of silt, sand and gravel. The Kame and outwash deposits are generally very pervious.

Other loose, pervious soils in the area are recent deposits of alluvial silt, sand, and gravel with some clay. These soils are localized and limited to streambeds and flood plain areas.

The bedrock underlying the entire dam and reservoir area is the Catskill Formation of the Susquehanna Group. This group of formations is of Upper Devonian age. The Catskill strata generally consists of well indurated red shale, siltstone and fine sandstone with some gray, green and brown shale, siltstone and sandstone layers. Occasional conglomeratic layers are encountered. The red shales are the dominant lithology and the residual soils derived from this rock are usually high in clay and silt and contain numerous flaky and angular fragments and flat, slabby boulders. The dam was constructed with residual soils from a borrow area on the left abutment.

The regional structure of the bedrock in the area indicates that the bedrock underlying the dam and reservoir area is gently folded. Surface exposures of red shale bedrock about 75 feet downstream of the dam on the right abutment strike N30°-40°W and dip 5°-10°SW. Red shale is also exposed 75 feet upstream of the dam on the right abutment where it strikes NS and dips 10°W. Red shale and fine grained sandstone, exposed in six to ten foot cliffs 200 feet upstream of the dam on the right abutment, strike N20°-40°W and dip 10°-15°SW. The right end of the dam is probably founded on bedrock.

Ref.: Ground Water of Northeastern Pennsylvania, Stanley W. Lohman, 1937; Bulletin W-4, Pennsylvania Geologic Survey.



0 1 2 3 4 5 10 MILES

SCALE: 1" = 4 MILES

LEGEND

PENNSYLVANIAN

ANTHRACITE REGION

Ppo — **Post-Pottsville Formations**
Brown or gray sandstones and shales with some conglomerate and numerous minable coals.

Pottsville Group
Light gray to white, coarse grained sandstones and conglomerates with some minable coal, includes Sharp Mountain, Schuylkill, and Tumbling Run Formations.

MISSISSIPPIAN

Mauch Chunk Formation
Red shales with brown to greenish gray clayey sandstones, includes Greenbrier Limestone in Fayette, Westmoreland, and equivalent counties. Loyalhanna Limestone at the base in southwestern Pennsylvania.

Pocono Group
Predominantly gray, hard, massive, cross-bedded conglomerate and sandstone with some shale, includes in the Appalachian Plateau Burgoon, Shenango, Cuyahoga, Corry, and Knapp Formations; includes part of "Oswayo" of A. J. Fuller in Potter and Tioga counties.

DEVONIAN

UPPER

CENTRAL AND EASTERN PENNSYLVANIA

Dos — **Oswayo Formation**
Brownish and greenish gray, fine and medium grained sandstones with some shale and scattered calcareous lenses, includes red shales which become more numerous eastward. Relation to type Oswayo not proved

Dck — **Catskill Formation**
Chiefly red to brownish shales and sandstones, includes gray and greenish sandstone tongues named Elk Mountain, Honesdale, Shohola, and Delaware River in the east.

Dm — **Marine beds**
Gray to olive brown shales, graywackes and sandstones, contains "Chemung" beds and "Portage" beds including Bucket, Trailer, Harrell, and Trimmers Rock. Tully Limestone at base

Ds — **Susquehanna Group**
Barbed line is "Chemung-Catskill" contact of Second Pennsylvania Survey County reports, barbs on "Chemung" side of line

NOTE:
GEOLOGIC MAP AND LEGEND OBTAINED FROM GEOLOGIC MAP OF PENNSYLVANIA BY PA. TOPOGRAPHIC AND GEOLOGIC SURVEY, DATED 1980

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MAPLE LAKE DAM
GEOLOGIC MAP

GEO - Technical Services, Inc.
HARRISBURG, PA

AUGUST, 1981

EXHIBIT F